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U. S. DEPARTMENT OF AGRICULTURE

REPORT ON AGRICULTURAL EXPERIMENT STATIONS AND COOPERATIVE AGRICULTURAL EXTENSION WORK IN THE UNITED STATES

FOR THE

YEAR ENDED JUNE 30, 1915

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
States Relations Service,
Washington, D. C., September 7, 1916.

Sir: I have the honor to transmit herewith a report on the agricultural experiment stations and the cooperative agricultural extension work in the United States for the fiscal year ended June 30, 1915, and on the work of the Department of Agriculture in relation thereto. This report has been prepared in accordance with the following provision of the act of Congress of March 4, 1915, entitled "An act making appropriations for the Department of Agriculture for the fiscal year ending June thirtieth, nineteen hundred and sixteen:"

That hereafter there be prepared by the Department of Agriculture an annual report on the work and expenditures of the agricultural experiment stations established under the act of Congress of March second, eighteen hundred and eighty-seven (Twenty-fourth Statutes at Large, page four hundred and forty), on the work and expenditures of the Department of Agriculture in connection therewith, and on the cooperative agricultural extension work and expenditures of the Department of Agriculture and of agricultural colleges under the act of May eighth, nineteen hundred and fourteen, entitled "An act to provide for cooperative agricultural extension work between the agricultural colleges in the several States receiving the benefits of an act of Congress approved July second, eighteen hundred and sixty-two, and of acts supplementary thereto, and the United States Department of Agriculture"; and that there be printed annually eight thousand copies of said report, of which one thousand copies shall be for the use of the Senate, two thousand copies for the use of the House of Representatives, and five thousand copies for the use of the Department of Agriculture (38 Stat. L., p. 1110).

This report embodies all the information heretofore submitted in compliance with the provisions of 34 Stat. L., p. 64, sec. 5, and 38 Stat. L., p. 374, sec. 7.

Very respectfully,

A. C. True, *Director.*

Hon. D. F. Houston,
Secretary of Agriculture.

Withdrawn
FEB 7 '40

PART I.

A REPORT ON THE WORK AND EXPENDITURES OF THE AGRICULTURAL EXPERIMENT STATIONS, 1915.

STATES RELATIONS SERVICE.

A. C. TRUE, Director.

OFFICE OF EXPERIMENT STATIONS.

E. W. ALLEN, Chief.

RELATIONS WITH INSTITUTIONS FOR AGRICULTURAL RESEARCH.

Supervision of Work and Expenditures of the State Experiment Stations under Federal Appropriations.

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G. M. TUCKER, Ph. D., Field crops.
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W. H. Evans, Ph. D., Chief.

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M. D. Snodgrass, B. S., Assistant in charge, Kodiak.
G. W. Gasser, B. S., Assistant in charge, Rampart.
J. P. Anderson, B. S., Horticulturist, Sitka.
T. D. Crippen, B. S., Assistant, Rampart.
H. E. Pratt, B. S., Animal husbandman, Kodiak.
J. C. Laney, B. S., Assistant dairyman, Kodiak.

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Peter Nelson, Assistant.

Hawaii Experiment Station.

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F. G. Krauss, Superintendent of extension work, Haiku.
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C. A. Sahr, Assistant agronomist.
Alice R. Thompson, B. S., M. A., Assistant chemist.
Valentine S. Holt, Assistant horticulturist.
A. T. Longley, In charge of cooperative marketing investigations.

Porto Rico Experiment Station.

D. W. May, M. Agr., Agronomist in charge, Mayaguez.
P. L. Gile, A. B., Chemist.
C. F. Kinman, B. S., Horticulturist.
R. H. Van Zwaluwenburg, B. S., Entomologist.
E. W. Brandes, M. S., Plant pathologist.
T. B. McClelland, A. B., Assistant horticulturist.
J. O. Carrero, B. S. Ch. E., Assistant chemist.

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WORK AND EXPENDITURES OF THE AGRICULTURAL EXPERIMENT STATIONS, 1915.

By E. W. Allen, E. V. Wilcox, and J. I. Schulte.

RELATIONS OF THE OFFICE OF EXPERIMENT STATIONS WITH THE AGRICULTURAL EXPERIMENT STATIONS.

The relations between the Office of Experiment Stations and the agricultural experiment stations continued to be of the same intimate and cordial nature as in previous years. While the administrative and supervisory duties made incumbent upon the office by the Hatch and Adams Acts are, from a purely formal standpoint, a primary function of the office, nevertheless, the advisory functions growing out of this relation have become an important feature.

The advantage of such a central agency was anticipated in the Hatch Act, which gave the department the broad authorization "in general, to furnish such advice and assistance as will best promote the purpose of this act." The form which this aid has taken has not varied greatly from year to year. The effort has been to sustain the stations in their legitimate work, to assist individual stations in overcoming unfavorable influences which militate against their efficiency, to present their needs of buildings and equipment, and to urge the importance of arrangements which will insure time and liberty to station officials for their proper work. Assistance is also rendered to the stations in perfecting suitable arrangements for carrying on cooperative work in connection with other agricultural agencies.

The whole effort of the office is directed toward encouraging and strengthening the stations and their work, by supervising their funds to insure that each station gets the full benefit of them in experimental and research work, and by protecting their interests in general and stimulating their activities so far as possible along lines of genuine investigation. The office is the central Federal agency for the experiment stations, established as an integral part of the machinery of agricultural investigation set in operation by the provisions of the Hatch and Adams Acts. The uniformly cordial relations which

have existed between it and the stations have helped to make its work effective.

With the provision of separate funds for extension work it has been made possible for the station workers gradually to withdraw from participation in teaching and extension work and to devote their energies more completely to the proper work of the experiment station, namely, investigation and experiment. This distinct separation of lines of work has made necessary a strict accounting for the funds devoted to these different lines of endeavor, and has to some extent increased the responsibility of the office in making the annual inspection of station accounts.

As in previous years, the guiding motive underlying the annual financial inspection made by the office is that of safeguarding the best interests of the stations and insuring the proper use of Federal funds for the legitimate purposes of experiment station work. It has long been apparent that the determination of the propriety of expenditures from the standpoint of the Hatch Act or Adams Act involves a consideration of the whole status and general condition of the station with reference to its efficiency, its relations, and its influence. Most stations have already found that, even with liberal State appropriations for experimental work in addition to the Federal funds, the strictest economy must still be practiced in order to carry on the lines of investigation which require immediate attention. Perhaps the most important general result of the annual financial inspection is the additional help and encouragement which the administrative officers of the station receive in husbanding their funds for use in furthering the proper work of the station.

While this department is charged, through the office, with passing upon and approving the annual financial reports made by the experiment stations in accordance with the schedules prescribed by the Secretary of Agriculture, the annual inspection of the stations involves far more than the mere inspection of accounts. Occasion is taken to consult with the director, the heads of departments, and other members of the station staff regarding the problems which they have in hand, the methods and progress of their work, the difficulties which they have encountered, and the possibilities of securing help in the furtherance of their research.

The insular stations, with which the office also has official relations, are upon a different basis. The office is in immediate charge of the experiment stations in Alaska, Hawaii, Porto Rico, and Guam. the appropriations for which are made directly to the department, The insular stations are administered through agents corresponding to the directors of the State stations. The connection, however, is much more intimate and the supervision more far-reaching than in the case of the State stations, which are immediately responsible to their local boards.



MONUMENT ERECTED IN MEMORY OF WILLIAM HENRY HATCH BY HIS FELLOW CITIZENS OF HANNIBAL, MO.

Through the medium of *Experiment Station Record*, an abstract journal prepared in the office, the progress of agricultural investigations throughout the world is made readily available to the station workers and others officially connected with the conduct of agricultural institutions.

A MONUMENT TO WILLIAM HENRY HATCH.

The memory of William H. Hatch, whose name is linked with the act establishing the American system of experiment stations, has been appropriately honored by the erection of a stately monument at Hannibal, Mo., where he had resided for 50 years. The monument was erected as a token of the affection and appreciation of his friends and fellow townsmen. It bears the inscription—

WILLIAM HENRY HATCH
FARMER STATESMAN LAWYER

BORN IN SCOTT COUNTY, KENTUCKY SEPTEMBER 11, 1833
DIED AT HIS HOME, STRAWBERRY HILL FARM NEAR HANNIBAL
DECEMBER 23 1896
REPRESENTATIVE FIRST DISTRICT OF MISSOURI
IN THE CONGRESS OF THE UNITED STATES
1879-1895
THE IMPRESS OF HIS PUBLIC SERVICE MAY BE FOUND IN
THE LEGISLATION OF HIS COUNTRY; THAT OF HIS PRIVATE
LIFE, IN THE HEARTS OF ALL WITH WHOM IT CAME IN TOUCH

A MEMORIAL FROM HIS FELLOW CITIZENS
1914

As shown in Plate I, the monument consists of a stone pedestal surmounted by a large bronze figure of Col. Hatch. It was erected through the efforts of a memorial association in the fall of 1914, but the dedication exercises were postponed till October 26, 1915.

Col. Hatch became a national figure by virtue of his stanch and effective championship of the experiment station idea. The experiment stations in every State of the Union are living monuments to his effort, and he will be gratefully remembered by all who follow the history of these institutions. The act which bears his name gave point and practical effectiveness to the legislation which had been shaping itself toward the establishment of agricultural experiment stations, and made possible the succeeding measures, which followed as a natural sequence.

RELATIONS OF INVESTIGATION AND EXTENSION.

The process of adjustment between experiment station work and extension work is not yet fully complete. Innumerable questions of detail have come up for settlement at the different stations. These problems are often of a peculiarly local nature, growing out of the multiform operations which have characterized the work of the experiment stations in the past.

On account of the fact that the experiment stations have found it necessary to carry on some extension work in addition to their proper work of research and experiment, it has naturally required much thought and careful judgment to arrange a program by means of which both lines of work may be carried on in harmonious cooperation while financed from distinct funds. It is now generally acknowledged that the establishment of sound agricultural doctrine requires careful research and experiment. The all-important and fundamental position of the experiment station in the further advancement of agriculture is therefore recognized at the outset. The problem of the extension departments is to provide for the reliable and authoritative dissemination and introduction of the facts and principles which have been determined by experiment and investigation.

At several of the agricultural colleges a satisfactory working plan has been found in assigning an extension worker to have his headquarters in that department which deals with the subject in which he is carrying on extension work. The extension men thereby become responsible to investigators for the accuracy and reliability of the agricultural doctrine which they may teach in their extension work, while remaining under the orders of the extension service with reference to the time and place of their operations. This plan of cooperation has been found to work quite smoothly. The extension men during the intervals between their field work are in constant contact with the experiment station workers, and therefore have opportunity to keep abreast of the latest information which has been developed as a result of their activities. The danger of promulgating questionable or discredited doctrine is thereby largely overcome.

The more serious phase of the problem of adjustment between the experiment station and extension work, however, concerns the division of the dual workers' time between the two activities. Many station workers are still being called upon for extension work, but it is becoming increasingly evident that only a small amount of such service can be expected and that the extension departments must be provided mainly with separate forces of workers, leaving the station men free to meet the needs of their experiments and investigations first of all. This plan is rapidly being put into effect.

At the same time it is desirable to make some provision by which station men will not be cut off entirely from contact with the farmers and their problems. There is abundant opportunity for doing this, and for adjusting it primarily to the needs of the station, without making the extension activities dependent upon it.

A separation between the lines of work and the maintenance of separate staffs for these different phases of agricultural work is necessary in order that the essential purpose and function of the experiment station shall not be confused in the minds of the workers and the public. Otherwise there might arise a tendency to forget that in many lines further agricultural progress waits upon scientific research. The laudable zeal for the teaching of better agriculture should not be allowed to minimize the necessity for the continued activity of the experiment stations along strictly research and experimental lines. It is true that a great body of facts and principles has already been established by the work of the stations and that this material may be employed in extension teaching to promote the adoption of better practices in farming. Progress in investigation, however, is slow and can not be hurried. It would be a fatal instance of overconfidence, therefore, to assume that the experiment stations may pause in their labors in acquiring exact information and devote their time and energies to widespread popular teaching of the information already at hand.

Agricultural problems of serious importance are constantly arising and still await solution at the hands of the experiment station workers. Moreover, the conclusions to which the station investigators have already come will be put to the most rigid test under a great variety of practical conditions. It would be surprising if some of these conclusions were not modified, or at least found economically inapplicable. In fact, the fear is not that station work as a whole may prove inadequate to the test as far as could reasonably be expected, but rather that through misunderstandings and overconfidence in its sufficiency the future of the station may be allowed to suffer. The progressive and fundamental investigation of agricultural problems is needed now quite as much as ever, and in some respects the need is more urgent.

Agricultural investigation is not merely time consuming—it requires also generous financial support. The limitation of funds is felt keenly at nearly every station. For this reason also it is obviously necessary for each station to guard zealously all the funds at its disposal and to make sure that they are used exclusively in the support of research and experiment and with proper regard to efficiency and economy.

POSITION OF THE STATION DIRECTOR.

With the sharper differentiation of the field and work of the experiment stations, and their more definite recognition as essentially institutions for research, the position of the station director has lost none of its fundamental importance. A strong organization of the station, the direction of its efforts along the lines of the needs of agriculture in the region, the maintenance of proper proportions and relationships in the work, and the provision of facilities and opportunity are quite as essential as they ever have been. Furthermore, the business management of the station, its publicity, and its contact with the agricultural interests, as well as with scientific organizations, call for considerate attention. The solidarity and the coherence of the station as a working body need to be maintained. This is more likely to prevail where the director has a firm grasp upon the organization of the staff and the conduct of the investigational and practical work of the station, guided by a definite plan and purpose of the station in the development of agriculture. There is likely to be a larger measure of cooperation among the departments of the station in working toward a definite end, accompanied with the enthusiasm toward research, the active interest in service to agriculture, and loyalty to the institution as a whole. Where, on the other hand, the director becomes too much preoccupied with other miscellaneous duties and fails to exercise the function of a general directing and correlating agency, a noticeable separateness is likely to develop, under which each department works and expands largely as an independent agency, seeking primarily its own advancement rather than the advancement of a general plan for the whole institution.

The duties of the station director have always been complex and exacting. They are becoming more exacting as the organization of the station increases in complexity, with the establishment of several departments, each of which may be further subdivided. In many cases the director of the station has become also dean of the college of agriculture, and sometimes the director of extension, and even the working head of the State department of agriculture. He is called upon to assume the responsibility for the control and inspection work with reference to fertilizers, feeding stuffs, insecticides, fungicides, creamery glassware, etc., sometimes to the extent of administering the laws and instigating prosecutions under them. The director has also felt called upon to represent the station in a public and official manner before meetings of farmers' associations, official agencies of State government, and before the State legislature. He has been compelled to become in a sense the attorney for the station, presenting its claims to the legislature for financial support.

It is obviously impossible for one man to fulfill all of these functions in an adequate manner unless he has competent associates or assistants. One or another of the different lines of work must inevitably be neglected. The day is not long enough, and the physical and mental energies of man are not sufficient to cover such a varied field of endeavor with success. The problem of how best to restrict his efforts to a narrower field is an urgent one for the director who has gradually become burdened with more duties than can be successfully borne. In a few instances, where the functions of director of the station and dean of the school of agriculture are combined in one man, a satisfactory arrangement for carrying the administrative burdens has been found in the appointment of an assistant dean and an assistant director. Each of these administrative assistants handles the details of his branch of the work. The dean-director is thus relieved of many executive burdens and has more time to consider the general problems of his office from a broader viewpoint.

In the case of most of the larger stations at the present time the position of director demands the full time and energy of a competent executive. The director must acquire a thorough and live understanding of the needs of agriculture in his State. He must be able to appreciate the relative importance and urgency of the problems which are presented for the consideration of the station. He must allot the funds of the station with due reference to the relative importance of these problems and with due regard to the rounded and well-proportioned development of the station as a whole. The director must be in a position to represent the station before the public, before the State legislature, and before associations and groups of citizens who may be interested in or affected by the station's operations.

In addition to these functions, which require a broad, enlightened view of the needs of the State and a sound business judgment in the coordination of the different departments of the station, the director is called upon to exercise general direction over the research work at the station. With the specific provision of other funds for the support of extension work, and with the gradual transfer of the control and inspection work of the stations to other State agencies, the station is left with its own great field of agricultural research, in which it is the chief official agency to which the citizens of the State look for help in acquiring accurate and adequate new information for the solution of live agricultural problems.

The station as an institution must therefore inevitably suffer so long as the director's time and energies are much occupied with matters not directly connected with the fundamental purpose for

which experiment stations were established. There needs to be leisure time for thought and wide reading in connection with the development of the general program of research in the station as a whole. The organization of the research energies of the station in such manner that they will tell most effectively in contributing to needed knowledge on agricultural problems is a matter which can not be left to chance or to brief and casual consideration in the intervals between other absorbing duties. The main duty of the director now centers in the problem of directing the course of station investigations in such a manner that they will be sound and thoroughly scientific, and also specifically aimed at the great agricultural needs of the State.

The position of director of the station has gradually become one which calls for good organizing and administrative ability, coupled with broad scientific training and an intelligent understanding of agricultural matters. No man is too highly gifted in physical and mental energy for the position of director. In order to be an actual source of inspiration to the research workers of the station a wide scientific training is required, coupled with a historical understanding of the purpose of the experiment stations, an appreciation of the great opportunities before these institutions, and a fine sense of fitness and proportion.

FUNDS AND EQUIPMENT.

The experiment stations, including the insular stations, received during the fiscal year ended June 30, 1915, a total revenue of $5,286,382.53, an increase of $121,694.57 over the revenues available the preceding year. Of this amount $1,558,379.57 was received from Federal appropriations, $2,129,604.04 from State and Territorial appropriations, and $1,598,398.92 from fees, contributions, the sales of farm products, and other sources. About 30 per cent of the total financial support of the stations came from Federal appropriations and approximately 40 per cent from State funds. The Alaska stations received $5,000 more from the Federal Government than in the preceding fiscal year, and this was the only increase in the Federal funds for the year. As compared with 1914, the State and territorial appropriations to the stations showed a decrease of $460,310.97, while the revenues derived from fees, sales of products, and other miscellaneous sources increased by $596,766.78. The apparent decrease in State funds resulted from the greater and stricter differentiation of the station work from the extension field and not from a failure to recognize the value of the various station enterprises or from any lack of interest on the part of the States in the experimental and research work conducted by the stations.

It is gratifying to note that in a number of States the stations were given liberal financial support for the upkeep and increase of their

equipment and for the active pursuit of the various lines of work within the desired sphere. In this connection it is of interest to mention that with the inclusion of balances from the previous year the total station revenues during the fiscal year 1915 amounted to $387,305.07 in Indiana, $343,316.25 in Ohio, $331,401.67 in Minnesota, $306,828.94 in Illinois, $275,870.25 in Kentucky, $222,255.37 in California, and $169,536.05 in Iowa.

The wisdom of State support and the value of the investment is reflected generally in the ability of the stations to attack agricultural problems greater in number as well as in scope and in the higher standing of these institutions as authorities in the special lines to which they devote their energies. In many instances States which began the support of their stations only a few years ago with rather modest appropriations are now contributing considerable sums as compared with the earlier allowances. While not all stations have yet the benefits of a State appropriation, the value and need of such assistance is now so generally recognized that during the past year only seven experiment stations were dependent solely upon the Federal funds for their support.

Among the important State appropriations to the stations and increases in lands, buildings, and other equipment the following are of interest:

A new propagating house especially adapted to Alaska's conditions was constructed at the Sitka station.

The Arizona station had a State appropriation of $27,400 for the year. The new agricultural building which will furnish office and laboratory room for the different station departments was completed at a cost of $165,000.

In California the station used approximately $124,000, or about one-fourth of the State funds appropriated for the maintenance of the department of agriculture of the university, to support its various projects or those carried on by the different branch stations. A decision was reached regarding the site for the Citrus station at Riverside, and an area of 465 acres, of which 350 acres are tillable, was secured.

The State legislature of Colorado made an appropriation based on a mill tax which will furnish about $28,000 a year for station work. During the year two silos, a greenhouse for horticultural work, and a straight-away concrete canal for the rating of water meters were constructed at the station.

The Connecticut State station purchased 15.4 acres of land adjacent to its experiment field, thereby increasing the area for station uses to about 35 acres.

The Connecticut Storrs station enlarged its dairy building and erected a two-story brick structure to be used for poultry work.

The Florida legislature passed the law known as the Florida plant act of 1915, which appropriated $195,000 for the eradication of citrus canker and $35,000 annually for nursery inspection and the suppression of plant diseases. The director of the station was made a member of the advisory committee in charge of the organization of the work under this act. The station dairy barn was enlarged and improved at a cost of $10,000.

The Georgia station received a State appropriation of $2,000 for use in repairing buildings and adding to the equipment of the laboratories and the library.

The Territorial legislature of Hawaii appropriated for the use of the marketing division for the year 1915–16 the sum of $14,400 for a new building and its equipment, and $1,000 a month for general expenses and maintenance. An additional appropriation of $7,500 was made to be used as a revolving fund for buying seeds and crates to be resold to farmers and for making advances on consignments.

The State appropriation for the Illinois station during the year was $195,000, of which $114,000 was allotted for agronomy, $31,000 for animal industry, $21,000 for dairying, and $29,000 for horticulture.

The State appropriation of the Indiana station for the year was $91,000, made up of a State agricultural experiment fund of $75,000, a fund for investigating swine diseases of $15,000, and $1,000 for creamery license work.

The Iowa station received a State appropriation of $106,300. A new plant laboratory building and greenhouses were completed and provided with quite full equipment during the past year. On the agronomy experiment farm an office, laboratory, and storage building was one of the principal additions to the equipment.

The State appropriation of the Kansas station, including the substations, amounted to $86,000. The sum allotted to the main station involved an increase of $10,000 over the preceding appropriation.

The Kentucky station received from the State the sum of $50,000 in addition to a relatively large sum received from other sources. Among the additions to the equipment may be mentioned a beef-cattle barn, built primarily to illustrate the methods employed in western Kentucky in the feeding and housing of beef cattle, and to serve as an inexpensive model of a barn of this type.

The Maine station received a State appropriation of $5,000 for the support of scientific investigation at Aroostook farm. In addition, private contributions supplemented the fund for this particular work.

The State of Maryland appropriated about $14,000 for the use of the station during the year, of which $4,000 was designated for use in horticultural studies and $10,000 for the general work of the station. The Ridgely substation farm of 50 acres, purchased at a

cost of $15,000, was turned over to the station October 1, 1914. For conducting work on this farm the State made an allowance of $1,500 for the year.

In Massachusetts the State appropriation to the station was increased to $25,000. A private estate was offered to the station for use in conducting experiments, and plans were made to begin this work.

At the Minnesota station a well-equipped cold-storage plant and a poultry brooder house were completed, and the construction of a field laboratory for investigations in plant pathology was begun. Increases in other equipment included additions to barns and new buildings in connection with the antihog cholera serum plant.

The total State fund available to the Missouri station was about $140,000, of which nearly $100,000 was for expenses connected with station investigations.

The State appropriation for agricultural investigation at the Nebraska station and the maintenance of substations was about $46,000.

The State of New Jersey provided the station with $25,000 for salaries and expenses, $20,000 for mosquito extermination, $4,000 for printing, $4,000 for poultry husbandry, $3,000 for floriculture, $2,000 for seed control, and $900 for oyster investigations. The new agricultural building was completed, and nearly the entire station staff was transferred to the new headquarters thus afforded.

The New Mexico station received as its initial State appropriation $5,000 to aid in the maintenance of the station work.

At the New York Cornell station a new building costing $120,000 was completed and was occupied by the department of soil technology. The animal husbandry building, costing $111,000, was also occupied, auxiliary poultry buildings costing about $25,000 were completed, and work on additions to the greenhouse to cost about $30,000 was begun.

In North Carolina improvements were made on the buildings of the branch stations to the extent of about $3,500.

The maintenance fund of $25,000 received from the State by the North Dakota station was increased by a special appropriation of $10,000 for live-stock work, $3,500 for dairy work, and $3,500 for use in the extermination of ground squirrels. A modern dairy barn and a milk house were completed at the station during the year.

The State funds at the disposal of the Ohio station during the past year amounted to about $270,000. A dairy building containing creamery, cold-storage, and receiving rooms, and dairy, chemistry, bacteriology, and milk-testing laboratories was erected at a cost of about $16,500.

During the year the Tennessee station constructed a live-stock pavilion costing $8,000 and built two concrete silos at the station farm. From private sources about $10,000 was received for use in horse and mule breeding investigations. A tract of land known as the Cherokee farm and comprising about 569 acres was acquired by the station. The purchase price of this tract was approximately $140,000, of which $25,000 was given by the city and individuals and the remainder by the county.

Several buildings, including a dairy barn with separate milk room, a greenhouse and insectary, and a storage building for soil samples and other material, were constructed at the Texas station. State funds received by the station amounted to $87,500 and were used in maintaining the substations and in supplementing the Federal funds at the main station.

The State of Utah appropriated $55,000 for a new building to be used jointly by the college and station for physical, chemical, and bacteriological work.

The State funds of the Virginia station for use in connection with maintaining and conducting the substations amounted to $16,000.

The State appropriation for the maintenance of the West Virginia station was approximately $21,000, which included $4,000 for horticulture, $2,000 for animal husbandry, $1,000 for tobacco investigation, $1,000 for poultry work, and $3,000 for printing.

The total State fund for the maintenance of the Wisconsin station for the past year was approximately $96,000. A large publication fund was available, from which $2,000 was set aside for the publication of research bulletins.

CHANGES IN PERSONNEL.

The persons engaged in experiment station administration and research work during the fiscal year ended June 30, 1915, numbered about 1,850. The changes occurring on the station staffs during the year included 284 resignations, 63 transfers to college and extension staffs, and 370 appointments, of which 8 were transfers from college staffs. Changes in the directorship occurred at only three stations. B. T. Galloway was appointed director of the New York Cornell station August 1, 1914; W. L. Carlyle resigned the directorship of the Idaho station in September, 1914, was appointed director of the Oklahoma station the following December, and was succeeded at the Idaho station in May, 1915, by J. S. Jones, who had been in charge as acting director. E. V. Wilcox, special agent in charge of the Hawaii station, who was transferred to the Department of Agriculture, was succeeded by J. M. Westgate, January 1, 1915.

Other important changes in personnel of the stations included the following: R. H. Williams was appointed animal husbandman at the

Arizona station, and W. H. Lawrence resigned as horticulturist to accept a similar position at the Missouri station. R. R. Dinwiddie, for many years pathologist and bacteriologist of the Arkansas station, resigned and was succeeded by C. L. McArthur, and W. L. Fowler, animal husbandman, was succeeded by H. E. Dvorachek. At the California station J. B. Davidson of the Iowa station was appointed in agricultural engineering, and at the Citrus station W. P. Kelley of the Hawaii station in agricultural chemistry, and H. S. Reed of the Virginia station in plant pathology. H. K. Hayes, in charge of plant-breeding work at the Connecticut State station, entered upon work of the same nature at the Minnesota station and was succeeded in his former position by D. F. Jones. In addition to the changes already mentioned at the Hawaii station W. T. McGeorge, appointed to succeed W. P. Kelley, was in turn succeeded by M. O. Johnson; D. T. Fullaway resigned as entomologist; F. A. Clowes, superintendent of the Hawaiian substations, was succeeded by J. B. Thompson; and F. G. Krauss, formerly agronomist, was placed in charge of extension work. At the Idaho station in addition to the change in the directorship, C. E. Temple, botanist, resigned and joined the staff of the Maryland Agricultural College, while J. F. Nicholson, bacteriologist, was succeeded by J. J. Putnam, and F. L. Kennard, agronomist, by N. S. Robb. J. B. Andrews was appointed animal husbandman at the Illinois station. W. E. Cross resigned as research chemist of the Louisiana sugar station, and his duties were assumed by M. A. Schneller.

At the Massachusetts station A. E. Cance, agricultural economist, C. E. Marshall, microbiologist, and F. H. H. van Suchtelen, soil microbiologist of the agricultural college, entered upon experiment station work with recognition as members of the staff; and G. E. Gage, animal pathologist, and H. D. Goodale, research biologist, were also added to the corps of station workers. H. R. Smith and K. F. Warner of the animal husbandry section, and E. W. Major of the dairy nutrition section of the Minnesota station resigned; L. D. H. Weld of the division of research in agricultural economics was succeeded by E. D. Durand, and J. T. Dinwoodie was appointed in the section of biological products in the division of veterinary science. At the Mississippi station H. B. Brown took charge of the cotton-breeding work upon the resignation of E. C. Ewing, E. P. Clayton succeeded J. K. Morrison in the poultry work, and H. K. Gayle was appointed animal husbandman. Among the changes at the Missouri station may be mentioned the resignation of W. L. Howard as horticulturist and the appointment of W. H. Lawrence to the vacancy.

In Montana P. N. Flint of the division of animal husbandry of the station was succeeded by C. N. Arnett, and H. E. Murdock was appointed in charge of the station work in agricultural engineering.

R. F. Howard was appointed horticulturist at the Nebraska station to succeed R. A. Emerson, now in charge of plant breeding at the New York Cornell station, and R. K. Bliss resigned his position as animal husbandman to take up the directorship of the agricultural-extension work at the Iowa Agricultural College. At the Nevada station F. W. Wilson was appointed animal husbandman, and Edward Records was added to the staff as bacteriologist. E. J. Ritzman resigned as animal husbandman of the Porto Rico station to take charge of similar work at the New Hampshire station. B. H. A. Groth, plant physiologist of the New Jersey stations, resigned, and his work was taken up by J. W. Shive. At the New Mexico station H. S. Hammond, botanist, resigned to accept a similar position at the Oregon Agricultural College, and the vacancy was filled by the appointment of J. M. Mann.

Among the changes other than the appointment of a director at the Oklahoma station may be mentioned the appointment of B. A. Ahrens as head of the poultry department to succeed A. F. Rolf, and of J. M. Fuller as head of the dairy department to succeed R. C. Potts. On the resignation of O. O. Churchill, M. A. Beeson was appointed agronomist. G. L. Fawcett resigned as plant pathologist of the Porto Rico station. In South Carolina C. A. McLendon was appointed as field pathologist of the station to succeed L. O. Watson and to have charge of the work in cotton resistance to anthracnose and in devising methods for controlling the disease. L. D. Batchelor, horticulturist of the Utah station, resigned, and W. H. Homer, jr., was temporarily assigned to the work. T. B. Hutcheson was appointed agronomist, F. D. Fromme, plant pathologist of the Virginia station, and W. K. Brainerd resigned his position as animal husbandman. F. D. Heald was placed in charge of the work in plant pathology at the Washington station. E. D. Sanderson, director of the West Virginia station, resigned at the close of the year, and J. L. Coulter, appointed to succeed him, entered upon his duties September 1, 1915.

During the past year the development of the agricultural extension work in all the States was an important factor in creating a demand for men trained in the various branches of agriculture. In many instances men were withdrawn from station work through offers of higher salaries for work in extension and other fields, and in numerous other cases station men, who are as a class well fitted for extension and demonstration work, were transferred to extension staffs. While the withdrawal of trained and experienced men from the station staffs interferes with the progress of experiment station work, it is fortunately offset to a great extent by the advantage arising from the freedom of the station from extension enterprises. It is to be hoped that the larger number of graduates from the agricultural colleges as

compared with former years will help materially to satisfy this demand for men and thus aid in making for greater stability in the experiment station as well as the extension forces.

SUBSTATIONS.

Increase in the number of substations during the past fiscal year was comparatively limited. This was largely the result of the definite and generally permanent establishment of substations in adequate number and area to meet the demands of the different States. The lines of work pursued under the conditions which obtain in the localities in which substations are maintained relate principally to the solution of agricultural problems of interest mainly to the particular sections as determined by soil, climate, topography, special crops, market requirements, and other factors of a similar nature which tend to diversify or otherwise affect the agriculture of an individual State.

In Arizona the experiment farm at Cochise, devoted primarily to experiments in dry farming, was enlarged by the addition of 40 acres, and the total area of the farm was thus brought up to 160 acres. About $22,000 was allowed for the year to maintain the dry farms and other outlying work.

During the latter part of the year the Colorado station entered into an agreement of cooperation with the Department of Agriculture to conduct a potato experiment station in the Greeley district of the State, the station agreeing to contribute not less than $5,000 for the work during the period ending November 30, 1916.

In Hawaii the territorial legislature failed to appropriate funds for substation work, which necessitated discontinuing work at all the substations except the one at Glenwood.

The State of Idaho appropriated for the biennium $5,000 for the maintenance of the Aberdeen substation, $4,000 for the Gooding substation, $2,000 for the Caldwell farm, and $4,800 for the substation at Sandpoint.

The State of Minnesota expended during the past year approximately $77,000 in maintaining its five substations and their activities.

During the year the Montana station severed its connection with the demonstration farms and devoted an increased amount of attention to the substations. A new substation was begun at Fort Assiniboine on a tract of 2,000 acres of land, and the legislature appropriated $5,000 for its annual maintenance.

The State appropriations of the Nebraska station for the past fiscal year included about $31,000 for the four substations now established.

In North Dakota the plans of work at the substations were materially revised in that more attention was given to work in animal husbandry than heretofore, when the activities centered mainly on crop production. The financial support by the State for the year amounted to $25,000, or $5,000 for each station. In addition the State made an allowance of $10,000 for the biennium for the inauguration of the animal husbandry work. During the year 22 demonstration farms were in operation with a total State support of $12,000. The work at the demonstration farms, however, now forms a part of the extension division.

The outlying work of the Ohio station was conducted at four district experiment farms and eight county experiment farms. Two of the county experiment farms were established during the past year, a farm of 275 acres being selected for this purpose at Canfield in Mahoning County, and one of 153 acres near Cortland in Trumbull County. The State law provides that the county experiment farms shall be under the management of the director of the experiment station, in order to secure a better coordination of the work and to prevent unnecessary duplication. The law also requires that a country experiment farm shall contain not less than 80 acres, in order to provide employment for at least one man and team throughout the year. The selection of these farms is further based on the adaptability, in part, at least, to the establishment of plat experiments in crop rotation, the use of fertilizers, and other similar work. The work is generally so planned that certain parts are an extension of that in progress at the main station, while other parts relate to problems not studied elsewhere or of special interest in the particular locality. This coordination and correlation of work constitutes an effective means of comparing different crops and varieties, methods and practices, and the results of experiments in general. In this way the results secured at the main station are given further tests under different conditions and thus find a wider field of application. The immediate supervision of the county experiment farm under the director of the main station is placed in a superintendent who is also the county agricultural agent, and the actual work of the farm is performed by a working foreman who employs additional labor as it is required. The object of the farm in connection with the work of the county agricultural agent is to discover, develop, and introduce the most profitable system of farming for the particular county.

The South Carolina station expended about $15,000 during the past year in maintaining the coast substation and the substation located at Pee Dee.

An assembly hall and live-stock pavilion was built at the West Tennessee station at a cost of $8,000, the greater part of which was contributed by the banks of West Tennessee and the farmers of that

section, and the rest was paid out of funds appropriated by the State to the West Tennessee station.

At the Washington station a new division, known as the dry land department and with headquarters at a branch station recently established at Lind, was created with State and contributed funds.

STATION PUBLICATIONS.

Much interest is rightly felt in the style and manner of presenting the results of station work in published form. While the results of station research are widely promulgated orally by the extension workers, the chief mode of direct contact of the station worker with his audience is through the written word in technical and popular bulletins.

If the station worker desires to have his bulletins read with interest he must, in writing them, meet the universal requirements of congenial intercourse and establish a bond of sympathetic understanding with the reader. In other words, he must consider his audience. This involves a frank appreciation of the reader's problems and viewpoint. A helpful bulletin contains a clear statement of the problem with due consideration of the reader's economically available means of overcoming the difficulties. The bulletin then proceeds to show just where the investigator took hold of the problem and something of the manner of the attack. The statement of the results obtained in the experiment is thereby placed in a natural and historical setting, which shows to advantage the amount of advance accomplished, the real value of the investigation, and perhaps indicates the present aspect of the question and the next line of attack. The reader is thus frankly taken into partnership with the investigator and looks forward with interest to future announcements of further progress.

The question of what and how many kinds of publications a station should issue is still under discussion. At the Berkeley meeting of the experiment stations, in 1915, this matter was discussed from several standpoints, but no great unanimity of opinion was disclosed. The subject was therefore referred to a committee for further consideration and report on a suitable program of station publications. In the meantime each station is working out the problem as best it can with due consideration of local conditions and requirements.

In general, there has been much progress in the direction of a differentiation of popular from the more technical accounts of station investigation, many stations issuing technical bulletins which are given special distribution. In other cases, contributions are published in various scientific journals, among them the *Journal of Agricultural Research*, issued by the Department of Agriculture in cooperation with the agricultural colleges and experiment stations. The number of station articles in the latter is assuming considerable

proportions, and its importance as a permanent record of station research increases with the extent to which this practice is followed. The bulletins intended for the general public deserve special care in their preparation. They are the station's means of communicating its work and its teachings to the nontechnical reader. They should therefore be adapted to his use and his understanding. Most investigators find their successful preparation more difficult than the writing of technical reports of their investigations. Some assistance in that line is often found advantageous.

Being issued by the station, the assumption should be that they find their basis in the work of the station, since the purely educational bulletin based on general information now lies in the field of the extension department. The matter should therefore be presented in such a way as to make its original character evident and show the station's contribution, in order that it may receive proper credit.

One station (Ohio) has recently made an innovation in its publications in the form of a monthly bulletin. This bulletin is to be issued as a monthly journal, and is to contain brief nontechnical and timely reports of progress on various phases of the station work. The monthly bulletin is to be sent to the full mailing list of the station. The other bulletins of the station are to be issued at irregular intervals, as the material becomes ready for publication, and are to be sent to restricted lists of teachers, investigators, and professional persons. This method of meeting the difficulties which have arisen in distributing station bulletins economically was adopted after thoughtfully considering the matter for several years. The practical operation of the scheme can become apparent only as experience accumulates, but it seemed to offer one method of bringing station work promptly to the attention of the farmer and general reader, and at the same time of satisfying the demands of investigators and professional men.

Many of the stations have found it necessary to secure the service of a trained editor in preparing manuscripts for the printer. The staff members are thereby relieved of much routine and detail work, to the advantage of all parties concerned. Moreover, in some of the stations the plan has been adopted of appointing an editorial committee from members of the station staff to read in a critical manner the manuscripts submitted for publication and to make constructive suggestions for strengthening or improving the bulletin. Where the work of a station editor or editorial committee is taken up in the right spirit the advantage of such an arrangement is manifest. Criticism from within the station will often prevent unfavorable and less sympathetic comment from without. It is manifestly wise to secure the critical judgment and approval of other departments on those phases

of a bulletin which lie outside the particular department in which the work was done.

The number of station publications issued during 1915 was 346 greater than that issued in 1913, and the volume increased 5,602 pages over that of the previous year. This increase refers strictly to publications issued by the stations themselves, and does not take into consideration the large number of scientific articles published in various technical and scientific journals, including the *Journal of Agricultural Research.*

THE EXPERIMENT STATIONS AS RESEARCH INSTITUTIONS.

Scientific workers who have reached middle life will readily call to mind a time not more than 30 years ago when the idea still widely prevailed in the United States that this country had as yet hardly caught the spirit of research. It was considered that a clear and calm atmosphere of investigation could not be expected to brood over the industrial turmoil incident to the process of material development. Our students and scientific workers flocked to Europe by the hundreds in search of institutions where the spirit of research could be imbibed and its methods learned. Partly as a result of ideas gathered in Europe, but largely as a result of the natural development of the intellectual energies of the nation, research institutions of the highest grade were founded at home. Research gained a solid footing earliest in endowed colleges, universities, and institutions established for investigation in special lines.

At first an unfortunate idea prevailed regarding the nature and purpose of research. This idea was associated with the rigid academic conception of pure science as contrasted with applied science. Research was held to be a thing apart and for a special class. It was given a certain aspect of other worldliness. The ideal investigator was to be a crusader who enlisted with almost religious fervor under the banner of truth. The battle cry was truth for truth's sake and science for science's sake. But truth and science were pure abstractions in the realm of ideas and had no necessary connection with the world of concrete things.

The establishment of experiment stations was in essence a declaration that if knowledge is power it is well to harness this power and connect it with the machinery of agriculture. In order to secure working staffs for the experiment stations a search was made for scientifically trained men who could effectively apply science to the service of agriculture. The whole idea was new and for the most part without historical background in this country. The problems presented for solution were legion and involved technical research in all of the pure sciences. These problems, however, were not for the most part of a simple nature, but necessitated the cooperative efforts

of various fields of pure science. A single problem might include the sciences of geology, chemistry, physics, bacteriology, and plant physiology. The new and endlessly complex problems which were presented to the station workers for solution required a fundamental readjustment of attitude, conceptions, and definitions of the very nature and purpose of research.

In the beginning of the experiment station movement much uncertainty prevailed as to the real function and ultimate outcome of agricultural investigation, and the ideas entertained by experiment station workers were much at variance. Gradually, however, their conceptions were clarified, and with the substantial progress of the scientific achievements of the stations and their encouraging success in applying the results of research to the service of agriculture, the proposition was at last firmly established that scientific research with a definite utilitarian aim is one of the highest and most generally useful callings to which a well-trained man can devote himself.

Naturally, the methods and possibilities of research were at first not well understood by the general public. Many urgent problems were presented to the stations, and some impatience was expressed if quick results were not obtained. The insistent demands for immediate results influenced some of the station workers against their better judgment to try a short cut to a solution of the problem in hand, and to publish the results of their experiments as a tentative solution. Some of these hasty experiments, done under pressure and published to satisfy an impatient demand, did much in certain instances to cast discredit upon the thoroughness and accuracy of experiment station work. It was made to suffer by comparison with investigation at endowed universities and other research institutions. Gradually, however, a broader view came to prevail in the management of the stations, a clearer understanding of the requirements for the final solution of complicated agricultural questions, and a larger measure of patience with the methods of science.

Conditions favorable to research have steadily improved, until at the present time it may be safely asserted that the experiment stations of the United States offer as favorable conditions and facilities for research as any class of institutions. In fact, in many respects their opportunities and facilities for research are superior to those of many institutions. There is a decided tendency to relieve the research men largely from other duties, either of a teaching or extension nature, and to allow them free time and free scope for the prosecution of the problems which they have in hand. It has at last been recognized that scientific investigation requires time and can not be hurried or interrupted. We no longer hear outbursts of impatience at the failure of an investigator to solve a problem within a few months. The general public has learned to trust the judgment

and skill and ability of the station investigators, and awaits with patience and confidence the conclusion of their research. Most of the experiment stations have provided the proper atmosphere and in generous measure the other conditions which are required for effective research.

These facts are gradually becoming known and appreciated in all classes of society, and particularly among scientists. It is recognized that all research carried on at public expense must have an ultimate utilitarian object. The differences in the aim of scientific work which were formerly thought to exist between agricultural experiment stations and endowed research institutions have disappeared.

With the gradual realization of these facts not only have the experiment station workers themselves devoted their energies more enthusiastically to the work of the station, but the best trained men in the country now gladly avail themselves of the great opportunities offered for research at the experiment stations. The stations are gradually becoming, as their name indicates, the agricultural research institutions of the country.

SOME RESULTS OF STATION WORK.

The range of investigations and experiments carried on at the stations is constantly extending, and the operations of the stations now cover practically the whole field of agriculture as ordinarily understood and include many special phases of research. As in previous years, considerable attention has been given, as required by State laws, to details of inspection, control, and related lines of service distinguished from experimental and research work. Gradually these lines of work are being taken over by other State institutions, thus leaving the experiment stations free to devote their energies more fully to research and practical experiment. On this account the proportion of station work which is strictly of an investigational nature is increasing, and the results obtained from this research are of fundamental importance.

It would be impossible to enumerate in this connection all the achievements of the experiment stations during the fiscal year. Some of the published results of their investigations are brought together, however, in the following paragraphs for the purpose of giving some hint of the important accomplishments of agricultural research at the stations. As in previous years, it is apparent that in many lines of investigation the results obtained at different stations have largely verified one another and have tended to establish firmly certain principles of wide application. In other cases the scientific results have been announced as tentative and may require further confirmation before they are definitely established upon a scientific basis.

AGRONOMIC INVESTIGATIONS.

Many interesting findings were made at the stations during the year along the line of plant breeding, cultural methods for various crops, water requirements for plants, and other phases of crop growth. In selecting and breeding corn for high protein and oil content it was found at the South Dakota station, as a result of four years' experiments, that corn high in protein produces a higher average yield than corn showing a lower percentage of protein. The average superiority in yield for the high-protein corn was about 3 bushels per acre. It was also learned that the percentage of oil in the dry matter of corn increases with the increasing maturity of the corn. Corn harvested August 15 showed an oil content of 3.06 per cent, while corn harvested September 19 contained 5.88 per cent of oil.

On account of lack of success in growing corn from seed obtained in the Northern States, the Arizona station carried on selection and breeding experiments with a strain of Papago sweet corn found in cultivation among the Indians. This work has been carried on since 1911, and a steady advance has been shown in the size of ear and the yield from this strain of sweet corn. In comparison with corn obtained from the Eastern States the Papago sweet corn yielded satisfactorily, while all but three varieties obtained from the Eastern States failed almost completely, and even the best variety was outyielded four times by the Papago sweet corn.

Much attention has been given to the problem whether plant characters may be fixed by the method of pure-line selection. At the Maine station this question was studied in connection with oats. It was found that the oat flower is almost always self-fertilized, thus making the process of line selection comparatively simple, even under field conditions. In the course of this work it was found that ordinarily in the year following a given selection there was an excess deviation in the direction of the selection, but that as a result of two or three successive selections a deviation appeared in the direction opposite to the selection. On the whole, this study gave no evidence that selection had modified any of the characters of the oat plant. It is concluded, therefore, that selection produces no hereditary effects which can be detected.

At the Ohio station similar results were obtained with respect to all characters except that of stiffness of straw and yield. Even these characters appeared to be more largely accidental sports or mutants which were less strictly of a hereditary nature. A variety of wheat was developed from Gypsy wheat through a selection made in 1906. This variety does not lodge under ordinary storm conditions and yields two bushels per acre more than the bulk of Gypsy wheat. The stiffness of the straw is a conspicuous character of this wheat

and has been shown to be fixed, hereditary, and not influenced by climatic or other conditions of environment.

The problem of determining the relative importance of climate and soil in modifying the composition of wheat is still receiving much attention. At the Minnesota station it was found that the variations in the composition and quality of wheat of the same varieties grown in different seasons or different localities during the same year were attributable chiefly to varying climatic conditions rather than to the fertility of the soil. In general, the bearded wheat or velvet-chaff wheat samples were slightly inferior to the bluestem wheats with which they were compared. On the other hand, an investigation of this problem at the Colorado station indicated that the mineral constituents of the wheat plant, particularly the straw, were decidedly influenced by the relative plant food supply in the soil. The application of sodium nitrate increased the total amount of ash, caused a depression in the amount of silicon, and an increase in the content of potash and lime. The application of phosphorus and potash to the soil uniformly lowered the amount of phosphorus in the plant, while the percentage of potash in the plant was apparently not affected by the application of either phosphorus or potash. Similar results were had at the Idaho station. The Washington station is also studying this problem.

The Kansas station possesses an exceptionally complete equipment for the study of the baking properties of flour. The chemical and baking experiments with flour during the year indicated a close relation between acidity and phosphorus and also between ash and acidity. It is suggested that this is perhaps due to the fact that a high ash content means a high phosphorus content and that a high acidity value may also be due to a high phosphorus content. It appeared during the course of this investigation that the method of milling has a more pronounced effect on the acidity and on the ash and phosphorus content of the flour than any variation in these constituents in the original wheat. As a result of general cultural studies with wheat and oats the Alabama station has obtained results which have led to a great increase in the production of both these cereals throughout the State.

During the course of the thrashing season in the Northwestern States an unusually large number of fires and explosions occurred in thrashing machines. This matter was thoroughly investigated by the Washington station with interesting results. The season was perhaps unusually dry, with a consequent low humidity of the air. Cereal smut was also unusually prevalent. Experiments with masses of smut spores showed that this material is readily inflammable. The investigations carried on by the station indicated that the fires or

explosions in thrashing machines were caused by a combination of conditions, including dry weather, great prevalence of smut, the consequent increased amount of organic dust from broken straw and grain, the increased combustibility of both smut and organic dust from its dryness and excessive fineness, and the increased amount of static electricity produced by the different parts of the thrashing machine under the unusually dry condition of the atmosphere.

During the course of the experiments in corn cultivation at the Minnesota station it appeared that to some extent the lack of cultivation is attended by an increased percentage of barren stalks. With a large increase in the number of cultivations the percentage of stand appeared to be lowered. The height of the stalks and of the ears on the stalk was not particularly influenced by the number of cultivations. In all instances the yield of corn per acre varied directly with the number of cultivations, being highest in plats which received the most cultivation. It was evident in these experiments that two cultivations are not sufficient in ordinary farm practice. In studying the relation of the number of stalks per hill to the yield it was found that not only the number but also the percentage of barren stalks increased as the number of stalks per hill increased.

The North Dakota station also made a study of the fertility of the soil as affected by weeds. In this work an effort was made to determine the relative composition of the weeds and also the comparative results of crops and weeds upon measured plats of ground. The average production of dry matter in wheat, as compared with the total dry matter of the wheat and weeds, was only 35.5 per cent; in flax the same relation was 30.4 per cent; for oats, 53.5 per cent; and for barley, 79.5 per cent.

The effect of the association of legumes and nonlegumes was studied at the Virginia station. This investigation leaves open the question whether a legume benefits a nonlegume under field conditions. It appeared that the soil moisture and nitrogen exerted more influence than could be attributed to the association of a legume with a nonlegume. This result obtained in the laboratory was further verified by field experiments with corn and beans. When bluegrass and white clover were grown together in the greenhouse no direct benefit was shown by their association. Likewise, no increase of protein appeared from the association of timothy and red clover. In the case of corn and beans grown under greenhouse conditions some benefit appeared to result from the association.

At the New Mexico station a study was made of methods of irrigating alfalfa. It was found desirable in irrigating the crop to use merely enough water to cover the ground at each irrigation and to irrigate as frequently as the crop requires water. It appeared also that the deeper the soil the smaller the total water requirement;

particularly on a sandy soil it was shown to be bad practice from an economic standpoint to make heavy applications of irrigation water. During the course of this study it appeared that with each increase in the total amount of water applied the quantity of water required to produce a pound of cured hay increased materially.

The problem of the water requirement of plants received earnest attention at the Nebraska station. It was found necessary to make a study of the extent of the experimental error as affected by the size of the potometer. In this work it appeared that the size of the potometer has a great influence on the growth of the plant and on its response to fertilizers. In small cans increased growth from fertilizers is much larger than in plats or large potometers. In these experiments the size of the containers varied from those holding 32 to those holding 1,000 pounds of soil. The results obtained in the study of water requirements of plants were found to be greatly modified also by the number of plants per pot. While the water requirement appeared to be less per unit of dry matter in the more fertile soil, the fertility of the soil increased the size of the plant, thus bringing about a greater actual water requirement.

In connection with a study of the so-called spindling-sprout disease of potatoes at the Maryland station attention was given chiefly to the physiology of potatoes in storage, and particularly to the action of catalase and oxidase. It appeared that on the basis of increase in total reducing sugars potatoes show a marked increase in diastase in storage, but on the basis of total sugar the diastase action is constant. It was found that while total sugars in potatoes amount to about 0.2 per cent at maturity, they may increase in cold storage to 3 or 4 per cent. It was shown, however, that potatoes do not sprout normally when the total sugar content of the tubers is more than 0.2 per cent. With a high sugar content in the tuber it is impossible for the sprout to withdraw moisture from the tuber, for the reason that osmotic pressure would be in the opposite direction. In connection with this investigation it was learned that the oxidase content in potato juice gives no indication of the intensity of respiration in the tubers. There appears, therefore, to be no correlation between oxidase activity and the rate of respiration in potatoes. Catalase activity, on the other hand, is strikingly correlated with respiratory activity.

Considerable work was done in the acclimatization of crops to special localities. At the Nebraska station a thorough study was made of the agricultural importance of soy beans in the State. Soy beans were found to be much better adapted to the Nebraska climate than were cowpeas. They did not show the effects of drought as quickly as corn and produced an average yield of 14.8 bushels per acre. It is concluded, however, that when soy beans are com-

pared, as they must be, with linseed meal as a concentrate, and when the whole crop is compared with corn as a general stock feed, the status of the soy bean in farm practice in Nebraska is somewhat uncertain.

Sudan grass received a great deal of attention at the experiment stations. In Texas the grass proved to be unusually valuable. It showed an acre-feeding value as great as that of Johnson, Bermuda, or timothy hay. It appears to be adapted to all parts of Texas. The average yield of hay during the year was 3.8 tons per acre. Sweet clover was also made the subject of experiment in several States. At the South Dakota station two cuttings a year were obtained, and the second crop of sweet clover hay was 2,430 pounds per acre. It was found that about 6 bushels of seed may be obtained as an acre yield. Sweet clover appears to be well adapted for growth in South Dakota and to have some promise as a forage crop.

SOIL INVESTIGATIONS.

At the Michigan station a scientific study of the effect of temperature on physical processes in soils has been under way for several years. It was shown that when one-half of a column of soil of uniform moisture content is maintained at 20 to 40° C. and the other half at 0° C. for eight hours, the moisture movement from the warm to the cold soil increases in all types of soil with the rise in moisture content in the sample to a certain degree, after which it decreases. The conclusion was reached that the capillary movement of water in moist soils is not controlled entirely by the curvature of capillary films but partly by the unsatisfied attractive forces of the soil for water. It was also found that the amount of water lost from the soil by water vapor is very small and that there is no rising of vapor during the night from the warm soil below to the cold soil above. From these facts it is concluded that the source of water for dew is not derived from soil vapor. It was shown that when a warm, moist column of soil is in contact with a dry column of soil the amount of moisture movement from the moist and warm soil to the dry and cold soil increases with the temperature and moisture content. These results indicate that temperature has a marked influence on the conservation of moisture by mulches.

The relation of soil moisture to the yield of winter wheat was studied at the Kansas station. It was found that ground plowed late in the fall contained on an average 2.7 per cent of available moisture at seeding time, as compared with 4.2 per cent in ground plowed in early fall and 8.8 per cent in summer-fallowed ground. The yield of grain was in all cases in direct proportion to the supply of available moisture in the soil at seeding time. It is concluded that a system in which the ground is summer fallowed once in three or four years will prove profitable.

The effect of cultivating corn upon the moisture content of soil was studied at the Illinois station. In this work it was shown that a deep, well-prepared seed bed is essential for conservation of moisture and will show a gain of 14.5 bushels per acre over soil that is poorly prepared. The results indicated that the destruction of weeds is the most important factor in cultivating corn, and that weeds reduce the yield of corn more by robbing it of plant food and light than by depriving it of moisture. During the past eight years 16 experiments have been carried on in which it was shown that a gain of 17 per cent in yield was obtained as a result of killing the weeds without cultivation. Apparently little moisture can escape, even from uncultivated land, after the roots are well distributed through the soil.

The problem of moisture conservation was also studied at the North Dakota station in connection with dry farming. It appears that climatic conditions are the chief determining factor in crop production in the western part of the State, and that the amount of rainfall during the growing season is of more importance than the total annual rainfall. Even with alternate cropping it appears that water is seldom stored to a greater depth than that from which annual crops can withdraw it. Shallow soils proved less responsive to tillage than deep soils. The prevention of the growth of weeds was found to be a more important function of cultivation than the maintenance of a mulch. In this work it appeared that summer tillage has a certain value but is not of primary importance in improving yields.

The New York Cornell station made a study of the relation of soil moisture and fertilizers to soil conditions. It was found that nitrates were always in greater abundance in an uncropped than in a cropped soil and were higher with 30 per cent of moisture than in either a drier or a wetter soil. On the other hand, ammonia was always higher in cropped than in uncropped soils. In these experiments the greatest quantity of both grain and straw was produced with 37.5 per cent moisture, but the relative quantity of grain was greatest with 20 per cent moisture. The total transpiration of the experimental plants was greatly affected by fertilizers and soil moisture. The conclusion is reached that the fertility of the soil exercises a great influence on the moisture relation of certain plants.

At the Texas station the percolation of water and mineral matter through soils was studied in pot experiments. It appears that clay and and loam soils allow more water to percolate than sandy and sandy loam soils. In the sandy soils cultivation increases the amount of percolation. Percolation of moisture is also increased by applying sulphate of potash or manure. The losses of potash and phosphoric acid in the percolating water were found to be very small.

The Tennessee station has devised an elaborate and apparently very efficient apparatus for use in the investigation of soil leachings, and has published a description of the device. The soil cylinders used in this apparatus are of different depths, and this arrangement permits data being secured with regard to the amount of water which passes through the soil at different depths.

At the Utah station special tanks were arranged to study the horizontal movement of salts through the soil. It was found that alkali salts are very readily transferred through the soil by moving water. Additional evidence is presented that low lands are being ruined by the accumulation of alkali salts as a result of overirrigation of lands lying at higher levels. At the California station it was shown that clay loam may be so badly puddled by the leaching of alkali salts as to be almost impervious to air and water. It was also demonstrated that alkali salts may be made innocuous to crops and soil bacteria by the addition of other salts, even though these salts are themselves toxic.

The study of the process of nitrification at the Ohio station has led to a belief in the necessity of refining and standardizing technical methods. Some doubt is entertained whether the usual determination of nitrates and ammonia in soils is of as great value as has been considered. It is suggested that since the nitrogenous substances are constantly undergoing changes, becoming either more or less complex, the mere determination of the nitrate and ammonia content of the soils may furnish misleading information as to what is going on. A study of nitrification in 93 soils at the Virginia station showed that cultivated soils have a decidedly higher nitrifying power than virgin soils. There appeared also to be considerable difference in the nitrifying power of virgin soils of various texture. No direct correlation was noted between nitrifying power and the ability to fix free nitrogen.

At the New Jersey station the effect of lime upon the availability of nitrogen was studied. Applications of limestone ranging from 1 to 10 per cent gave more than double the amount of dry matter obtained without lime and somewhat more than that obtained by the application of nitrate of soda. In general, better results were obtained from the use of limestone than from moderate applications of nitrate of soda. In experiments with cereals nitrate of soda invariably gave higher results in the first crop than dried blood. The availability of nitrogen from these two sources was as 100 to 72.

The Iowa station made an investigation of methods for determining ammonia in soils. It appears that the amount of ammonia extracted by hydrochloric acid is within certain limits independent of the strength of the acid and the period of extraction. Hydrochloric acid was found to remove 60 to 70 per cent of the ammonia. The

percentages of ammonia obtained by extraction with hydrochloric acid were much lower than those obtained by direct distillation of the soil with magnesia.

The effect of green manuring on soil nitrates was made the subject of study at the Virginia station. It was found that the organic matter of blue grass, clover, and alfalfa when plowed into the soil was readily transformed into nitrates, and that the total number of bacteria in the soils treated with green manures was greatly increased. The rate of nitrate formation was also improved by the presence of green manures.

At the Mississippi station it was found that there is a direct relation between the bacterial count and the amount of green manure or barnyard manure added to the soil. Moreover, the quantitative bacteriological test and the crop test agreed quite uniformly. Evidence was accumulated that the benefit derived from the addition of stable manure is largely due to the addition of the bacteria contained in the manure.

In pot experiments for the purpose of determining the effect of organic compounds the Texas station found that vanillin and quinone applied to the soil before planting, at the rate of 100 parts per million, injured the growth of only 1 out of the 8 crops. Vanillin is readily oxidized in the soil and a considerable portion of it disappears within two weeks. Little evidence was obtained that fertilizers overcome the injurious effects of vanillin and quinone. The Alabama station is also studying the effect of organic compounds in soils.

In experiments in the use of lime at the Pennsylvania station during a long series of years it was found that the use of burnt lime gave no crop increase, while pulverized limestone showed a crop-producing value of $1.20 per ton of limestone used. No evidence was obtained that caustic lime causes the loss of soil nitrogen by the destruction of organic matter to any objectionable extent. At the Iowa station the lime requirement of soil was found to be from 3½ to 5½ tons per acre. After the acidity of the soil has been neutralized it appears that the use of 1 to 2 tons of limestone per acre every five years will be sufficient. Ground limestone or limestone screenings are recommended as the best and cheapest forms in which to apply lime.

The Rhode Island station has been conducting experiments on the effect of lime on different plants for the past 22 years. The experiments have included 280 different varieties of flowers, trees, small fruits, grasses, clovers, and miscellaneous crops. It appears that the difference in the residual effect of sulphate of ammonia and nitrate of soda on the soil acidity is quite marked. Among the plants which were found most sensitive to soil acidity mention may be made of asparagus, barley, beets, celery, leek, lettuce, onions, clover, spinach, and tobacco.

As a result of the long-continued experiments with lime at the Ohio station it is concluded that on soils deficient in lime it is as necessary to make good this deficiency as it is to make good the deficiency of nitrogen, phosphoric acid, or potash. It appears that lime applied to the corn crop in liberal quantities favors the production of nitrates for the use of several succeeding crops. A study of ground limestone for acid soils was carried on at the New York State station. In this experiment it was found that on account of the increased cost of producing and handling limestone ground to great fineness a coaser grade is more economical. It is concluded that limestone ground to such fineness that the entire product will pass through a 10-mesh sieve is satisfactory.

At the Wisconsin station a new test for soil acidity was devised. This test consists in adding zinc sulphid to acid soils and determining the amount of hydrogen sulphid given off.

As the result of an experiment extending over 20 years at the Rhode Island station it was found that of the various sources of phosphoric acid, dissolved bone black takes first rank, while dissolved phosphate rock holds an intermediate place.

At the Wisconsin station the addition of monobasic potassium phosphate to a peptone culture solution was found to cause a great increase in the production of ammonia. The sulphates of lime and potash also increased ammonification to a small extent. Incidentally it was shown that monobasic potassium phosphate resulted in a great increase in the number of bacteria. On the whole, the experiments indicate that possibly the increased crop production of the soil to which soluble phosphates have been added is due in part to the stimulation of bacterial activity.

At the Massachusetts station a study of phosphate fertilizers indicated that the more soluble phosphates are better adapted for use in Massachusetts soils than the finely ground natural-rock phosphates. It appears also that phosphoric acid is subject to much less waste under usual conditions than is potash. No evidence was obtained that the soils are being depleted of phosphoric acid. In spite of the relatively greater supply of potash than of phosphoric acid in the soils, the application of potash in soluble forms has produced larger crop increases than has a similar application of phosphoric acid. It is strongly recommended that soluble phosphates be used rather than rock phosphates.

The relation of sulphur to soil fertility was investigated at the Kentucky station. Analyses of 31 varieties of tobacco showed that only two of these varieties contained less sulphur than phosphorus. A decided increase in the yield of tobacco was produced by the addition of sulphur or gypsum to a fertilizer mixture. Sulphur also produced an increase in the yield of soy beans and turnips. Clover

was apparently not benefitted by the addition of sulphur. It was found that when sulphur is added to the soil it is rapidly oxidized into a sulphate. This oxidation of sulphur tends to increase the acidity of the soil. At the Iowa station it was found that the optimum moisture content of the soil for the oxidation of sulphur is 50 per cent of the amount necessary for complete saturation. The amount of air in the soil was also shown to have an important effect on "sulphofication." The addition of barnyard manure or green manure within certain limits was shown to stimulate the oxidation of the sulphur in the soil.

The Massachusetts station made a study of the toxic effect of iron and aluminum salts on clover. It appears that aluminum sulphate when present in culture solutions in concentrations greater than 40 parts per million has a decidedly toxic effect on clover, and that ferrous sulphate is toxic to clover when present in concentrations above 4 parts per million. It was shown, however, that this toxic effect of iron and aluminum can in a large measure be counteracted by the use of calcium carbonate.

At the North Carolina station it was shown that by the use of phosphoric acid and nitrogen on sandy loam and clay loam soils an average increased yield of 69 per cent of shelled corn per acre can be produced. A comparison of dried blood and nitrate of soda as sources of nitrogen gave results in favor of the latter. This station also showed that there is a close relation between the chemical and minerological composition and the fertilizer requirements of soils. At the South Carolina station it was found that phosphoric acid is the limiting factor for the growth of both corn and cotton in the coastal-plain section of the State. When applied alone or in combination with potash or nitrogen ground phosphate rock was more profitable than acid phosphate. When both nitrogen and potash were used the acid phosphate gave the best results. The most favorable time for applying nitrogen to cotton was found to be the stage at which the squares begin to form. Both cotton and corn received more benefit from nitrogen of an organic source than from inorganic nitrogen.

At the West Virginia station in experiments in fertilizing peach orchards, it was demonstrated that the yearly growth of trees treated with nitrate of soda was double that of trees which received no nitrogen. At the end of the second year the leaves of trees which received nitrates were healthier and about $2\frac{1}{2}$ times as numerous as those on trees which received no nitrogen. Nitrogen appeared to produce a strong growth of wood and foliage, while potash weakened the vigor of the tree. The maturity of the fruit was delayed somewhat as a result of applying nitrogen, but the gross income per acre was nearly doubled.

At the Ohio station it was found that lettuce can be grown continuously in the greenhouse without renewing the soil. This experiment has been carried on for several years, and the soil has received annual applications of barnyard manure. It appears that lettuce is relatively much less subject to soil diseases under such conditions than are tomatoes and cucumbers.

The Illinois station gave some attention to the use of radium as a fertilizer. As a result of two years' experiments it was found that radio-active material applied to different plats at a cost of $1, $10, and $100 per acre produced no effect upon the crop yields either during the first or second years. No evidence was obtained that radio-active material can be applied to the soil with profit as a fertilizer. A study of the Pacific Coast kelps as a source of potash by the California station confirmed the view that giant kelps contain potash, iodin, and nitrogen in amounts which may justify commercial recovery. It appears that air-dried kelp will furnish a low-grade potash fertilizer containing also more than 1 per cent of nitrogen and 50 per cent of organic matter.

ANIMAL HUSBANDRY.

In a practical feeding experiment at the Pennsylvania station it was shown that corn silage valued at $3.50 a ton was somewhat more economical for use as the exclusive roughage for steers than a combination of mixed hay and silage. The use of mixed hay and corn stover as roughage did not prove satisfactory. Alfalfa hay fed at the rate of 5 pounds per 1,000 pounds live weight, in combination with corn silage, proved less efficient as a source of protein than 2½ pounds of cottonseed meal per 1,000 pounds of live weight. It was found to be unprofitable to feed a ration of 5 pounds of alfalfa hay with 2½ pounds of cottonseed meal per 1,000 pounds live weight.

At the Nebraska station a ration of corn and alfalfa hay produced cheaper gains than any other ration under test. Moreover, the gains were made as rapidly as from any other ration. The use of cold-pressed cottonseed meal gave results inferior to those obtained with alfalfa hay in a ration for fattening steers. In all cases the steers which received silage shed their coats in early spring and kept in excellent condition. It was found that an advance of 8 cents per bushel in the price of corn would increase the cost of gains in steers to the extent of $1 per 100 pounds.

In feeding experiments at the South Dakota station corn silage produced more than twice as much gain as sorghum silage when fed as a sole ration. The large gains secured during the first 91 days of these experiments were maintained when the steers were put on the full fattening ration. It was concluded that where the corn plant will mature there is no benefit to be derived from growing sorghum

for the silo. A comparison of various leguminous forage crops indicated that alfalfa hay was the most effective. Sweet clover, when cut for hay before the stems became woody, was found to be as valuable as alfalfa hay for feeding with corn silage during the preliminary period.

Careful experiments were carried on at the Missouri station in determining the maintanance ration for cattle. In the course of this study it was shown that an average consumption of 8 grams of digestible nitrogen and 170 calories of energy per 100 grams of body nitrogen a day are sufficient for maintenance. Stated in the quantities required for 1,000 pounds of live weight, 0.889 pounds of digestible protein and 12.92 therms of energy were sufficient for maintenance. It appeared that the cost of maintenance was relatively high after a previous period of full feeding, and that the higher the previous plane of nutrition the greater was this increase in cost. It was also shown that the cost of maintenance decreases with increasing age, and is least in the spring and greatest in the winter.

The efficiency of the nitrogen of alfalfa hay and corn grain for milk production was compared at the Wisconsin station. In this work it appeared that the acid amid nitrogen of alfalfa is small in amount, constituting 1 per cent of the total nitrogen, while the amino acid nitrogen makes up about 10 per cent of the total nitrogen. No indication was obtained in these experiments of the nutritive value of acid amid nitrogen. Apparently the nutritive value of the nitrogen of roughages depends upon the nature of the total amino acid content in the feeds. Incidentally it was shown that alfalfa hay has specific diuretic effects and also causes a considerable shrinkage in the flow of milk.

The Connecticut State station continued its study of proteins, particularly those of brewers' grains, oil cakes, and corn.

Experiments in feeding western lambs were carried on at the Indiana station. These experiments indicated that the addition of corn silage to the ration of shelled corn and clover hay reduced the quantity of grain consumed and the rate of gain made by the lambs. Lambs fed corn silage as the only roughage, however, showed irregularities in appetite. Excellent results were obtained from the addition of clover hay to a ration of shelled corn, cottonseed meal, and corn silage. The use of oats in the same ration did not affect the rate of gain. The gains in the lambs were greater and more economic in the open shed than in a ventilated barn.

The Ohio station gave much attention to the study of the specific effects of rations, particularly on the development of hogs. In these experiments several rations were compared, including corn alone and corn supplemented by soy beans, wheat middlings, linseed meal, tankage, and skim milk. The rations were fed in such quantities as

to give the same amount of digestible nutrient per unit of live weight of pigs. A comparative measure was thus obtained of the value of protein from different sources. The capacity of milk protein to produce a proteid increase in pigs was found to be greater than that of protein from vegetable sources and tankage. Corn supplemented by soy beans, linseed meal, wheat middlings, tankage, and skim milk failed to furnish mineral matter of the amounts and quantities required for the best growth of bones. The least bone was produced by the rations of corn alone and corn and soy beans. The largest percentage of flesh and least fat and the smallest percentage of bone was shown in the lot which received corn and linseed meal. The amount of ash per gram of bone and the breaking strength of the bone were shown to vary together in the following order of decreasing magnitude: Corn and skim milk, corn and tankage, corn and linseed meal, corn alone, corn and wheat middlings, corn and soy beans. On the whole, the experiments indicate the great poverty of cereals in lime as an element of food.

Another line of work carried on at the Ohio station involved a comparison of different phosphorus compounds in animal nutrition. The basal ration consisted of hominy, wheat gluten, blood albumin, corn bran, agar, and salt. A number of organic and inorganic phosphorus compounds were used. At first it appeared that organic phosphates, particularly glycero-phosphates, were more efficient than inorganic phosphates. Later it was found that all phosphates are about equal in nutrient efficiency. The Wisconsin station is also studying the physiological effects of phosphates.

Interesting results were obtained at the Georgia station in studying the associated digestibility of corn silage, cottonseed meal, and starch in steer rations. Starch when fed to excess seemed to exercise a depressing effect upon the digestibility of protein and crude fiber. When 47 per cent of the net energy of the ration was furnished in the form of starch, a depression in the digestibility of ash also appeared. It was found, however, that this depression could be largely overcome by the addition of cottonseed meal without diminishing the amount of starch in the ration. An increase in the quantity of crude fiber in the ration did not unfavorably affect the digestibility of the nitrogen-free extract. It was also shown that when steers are changed from one ration to another they do not at first digest the ration so completely as occurs somewhat later.

POULTRY INVESTIGATIONS.

An interesting apparatus for studying the vigor of germ in hens' eggs has been devised at the West Virginia station. The apparatus consists of an electrically heated incubator in which each egg is placed in a glass tube through which the air is drawn and the quantity of

carbon dioxid given off by the egg is accurately determined. A dozen eggs are incubated simultaneously, and the determination of carbon dioxid is made at frequent intervals. The amount of carbon dioxid given off is taken as a measure of the growth activities of the embryo. The investigation will involve a study of the correlation between the subsequent growth of the chicks hatched in the experiment and their embryonic activity as shown by excretion of carbon dioxid. The amount of carbon dioxid given off by different eggs has been found to vary greatly. The Oregon station found the moisture factor to be of more importance than carbon dioxid.

Experiments in breeding fowls for high egg production were continued at the Utah station. In this work hens varying in age from 1 to 7 years are under observation. It appears that the average productive life of the strain of fowls upon which the experiments are made is about four years. There has been found to be a fairly definite potential laying capacity in the fowls which finds expression in the first three years. More hens made their highest annual record after the first year than during that year, and three hens produced their record yield during the fifth year. It is concluded, therefore, that a 3-year average is the most reliable index of the value of a given individual to be used in selection. At the Rhode Island station it was demonstrated that the White Leghorn breed has a factor for black pigmentation, and that this leads to complexities in pattern or color of the plumage when the White Leghorn is crossed with other white breeds. Dark barrings and other color marks may appear as a result of the introduction of the White Leghorn blood.

The Connecticut Storrs station continued its feeding experiments with poultry. It was found that the feeding of milk to young chicks has a most favorable effect on their growth and in lessening the mortality. If milk is fed early enough and continued for long periods it appears to reduce the death rate from bacillary white diarrhea. In these experiments sweet and sour milk proved to be of equal value in relation to both growth and mortality. Different degrees of souring appeared to have no effect upon the feeding value of the milk. While the experiments indicate no preference between sweet and sour milk, except from the standpoint of convenience, it was found desirable that the same kind of milk be supplied throughout the milk-feeding period.

In a study of rations for growing and fattening capons at the Ohio station it appeared that a ration which contained a constantly decreasing quantity of protein produced a slower rate of gain at a higher cost of gain than rations which carried the same proportion of protein throughout the experiment. Incidentally it was shown that capons confined in small pens from the beginning of the experiment gained 17 per cent less than capons allowed free range for the first 12 weeks of the feeding test.

DAIRYING.

The dairy investigations at the stations during the year covered a wide range of subjects. From these numerous experiments a few may be selected as perhaps of special interest. At the New York State station a study was made of the quality of milk as correlated with present dairy score cards. Several systems of score cards were used. These score cards have been devised for the purpose of grading dairies with reference to the probable sanitary condition of the milk produced in them. After thorough comparison of the standing of certain dairies as determined by the score-card system and the sanitary condition of their milk as determined by chemical and bacteriological examination in the case of 34 commercial dairies, it was found that so far as the quality of the milk can be determined by present laboratory methods there is no relationship between the quality of the milk and the dairy score on the score cards now in use. Milk of all grades ranging from the best to the poorest was found in barns which would be excluded on account of low scores, and conversely all grades of milk were likewise found in barns which scored high. While these results are not construed as showing the worthlessness of dairy score cards, they are held to indicate that the present score cards can not be satisfactorily used as a means of grading milk according to quality.

The Iowa station carried on some elaborate experiments in the pasteurization of milk and cream. Considerable attention was given to the pasteurization of milk in bottles. The method of pasteurization used for bottled milk is a modified vat method adopted because of the slowness with which bottled milk can be heated. It was found that high temperatures were unsatisfactory in pasteurizing the milk in bottles because of the decreased creaming ability and cooked flavor of the milk so treated. An exposure for 50 minutes in water at 145° F. gave quite satisfactory results, and the cooked flavor could not be generally detected. The intensity of the cooked flavor of milk appears to depend to some extent upon the amount of fat present, being more noticeable in milk with a low fat content. The pasteurization temperature just mentioned was found to be satisfactory in bottles containing a half-pint, a pint, or a quart.

The Iowa station also studied the pasteurization of cream as related to its butter-making properties. Pasteurization of sour cream in vats at a temperature of 140° to 145° F. for 20 minutes failed to destroy all the bacteria. The process was more complete after pasteurization by the flash method at a temperature of 180° to 185° F. By the use of the method of double pasteurization in the case of sour cream a very high efficiency was secured. This method was more effective than that of pasteurization in vats. Bacteriological studies in connection with this work indicated that there is no exact relation

between the number of living bacteria in cream and its acidity. There appeared also to be no correlation between the acidity of the cream and the number of organisms, remaining alive after pasteurization.

At the West Virginia station an elaborate study has been made of the efficiency of high pressure in destroying bacteria in milk. A number of experiments were tried in inoculating the milk with pathogenic organisms and then subjecting the samples to pressure. It seemed that tubercle bacilli in milk would withstand a pressure up to 60,000 pounds per square inch. Lactic-acid bacteria endured a higher pressure than any other group of organisms. The experiments indicate that 75,000 pounds per square inch is the lowest pressure to be relied upon for pasteurization of milk.

RURAL ECONOMICS.

During the year the stations made many important contributions to the study of the cost of production of crops and farm animals, the cost of farm operations, and scientific methods of farm management and marketing. In a study of the cost of production on farms, the Missouri station found that the average cost of keeping a work horse was $88.33 per year, that the cost of horse labor per hour was 7.9 cents, and that the length of the workday per horse varied from 1.8 hours in January to 5.8 hours in May. A summary of the records obtained at the Missouri station indicated that corn yielding less than 30 bushels per acre paid a very small profit for man labor, while corn yielding more than 30 bushels per acre paid an average profit of nearly 38 cents per day's work. Corn appeared to be the most profitable of the various crops studied, followed in the order of profitable returns by clover, cowpeas, soy beans, and wheat.

At the Colorado station a study was made of the cost of production and operation on the station and college farm. In this study it was found that the cost of man labor varied from 19 to 23 cents per hour, the cost of horse labor from 7 to 12 cents per hour, and the total cost of farm machinery from 12 to 15 cents per acre. Careful data were also collected on the cost of production of various crops. In the case of alfalfa it appeared that the cost per ton during a 4-year period ranged from $3.62 to $5.10.

At the Cornell station a quite elaborate study was made of the cost of milk production. The data was collected in commercial dairies in Jefferson County and were obtained from a study of a full year's record for 53 dairy herds. The average yearly production per cow in these herds was 6,621 pounds of milk and 241 pounds of butter fat. The average cost of production was $1.21 per 100 pounds of milk and 33.3 cents per pound of butter fat. The average selling price of milk was $1.52 per hundred pounds, and the net profit per cow was $20.39.

It was found that the average cost of feed per cow was $51.57, or 64 per cent of the cost of keep. Incidentally it was shown that the profit from cows yielding 10,000 pounds of milk per year was 51 per cent greater than that from cows yielding 6,000 pounds.

The problems connected with cheese marketing were given a thorough investigation at the Wisconsin station. This study was entirely in the field of organization and economics. The evidence obtained in this investigation indicates that direct marketing of cheese to the consumer is practically impossible, that cooperative management of an individual cheese factory fails to solve the problem completely, and that a substantial improvement in the methods of marketing cheese can probably be brought about only as the result of concerted action following a constructive program of general affiliation among all the cheese factories of the State.

The economics of orcharding has received serious attention in recent years. The Oregon station conducted an economic investigation of orcharding on 1,000 orchards located in Washington, Idaho, and British Columbia. The data used in this investigation were obtained from farms which had at least two-thirds of the entire acreage devoted to orchards and at least two-thirds of the orchard devoted to apples. The figures obtained in the course of this work indicated that the average cost of clearing land and planting apple trees in the Northwest is about $112 an acre, and that the average cost of maintenance and development of a young orchard ranges from $52 to $62 an acre, depending upon the age. In considering all the elements of cost, including maintenance, overhead charges, and handling, it appeared that the average cost of a box of apples from orchards 6 to 9 years old was $1.18, and from orchards 10 to 18 years old was 95 cents. Incidentally evidence was obtained that the number of varieties of apples in commercial orchards should be greatly reduced and that probably not more than a dozen varieties of apples should be grown in the Northwest. Some of the chief sources of loss were found in the improper use of fertilizers, poor systems of pruning, careless spraying, and lack of facilities for handling the crop.

The economics of spraying orchards was made a subject of study at the Missouri station. In this work data were obtained on 30 orchards, covering two years. During the season of 1914 the average cost of all materials was 6.6 cents per tree for the first application, 13 cents for the second, 9.5 cents for the third, and 8 cents for the fourth application. The average cost of spraying twice was $11.76 per acre, for spraying three times $17.46, and for spraying four times $22.26. A wide range of actual profit was shown in different orchards from the spraying operations, varying from $161 to $300 per acre.

ENTOMOLOGICAL INVESTIGATIONS.

A long series of experiments was carried on with methods of combating the three species of plant lice which most seriously attack the foliage of apple trees. The New York State station found in this work that efforts to protect bearing apple orchards from the attacks of plant lice are as a rule failures. Apparently the most effective and satisfactory means of preventing the attack of plant lice upon the young fruit is to apply sprays upon the expanding buds. For this purpose the most efficient spraying mixtures were found to be nicotin solution, oil emulsions, and soap preparations. The time for most effective spraying varies in individual orchards and with different varieties of apples.

Further experiments were carried on at the Illinois station in perfecting remedies for the control of the corn root aphis. The efficiency of the method previously announced received additional confirmation. It seems that the principal measures of protection against the corn root aphis are found in a suitable rotation of crops, an early and deep plowing followed by repeated disking, especially where the ground is badly infested with ants, and the use of repellent substances at planting time. As a result of the deep plowing and repeated disking a diminution of 43 per cent was noted in the number of hills infested by ants.

At the New Hampshire station an elaborate study was made of the habits, life history, and means of combating the apple maggot. On the basis of knowledge gained on the life history of this pest it is suggested that there is no danger from apples which fall in June, but that all apples which fall from the middle of July to the middle of September should receive attention to prevent the further development of the apple maggot. The essential point in the control of this pest is to prevent infested fruit from decaying on the ground. All windfalls should therefore be collected promptly and fed to live stock or utilized in some other manner so as to destroy the apple maggot.

The recurrence of serious outbreaks of injurious grasshoppers led the Utah station to make a study of practical means for controlling these pests. It was found that the most efficient and economical method for controlling grasshoppers consists in locating the breeding grounds and destroying the eggs. It was an easy matter to locate the areas where the eggs were deposited in great numbers. These areas were then thoroughly harrowed for the purpose of breaking up the egg masses. A large percentage of the eggs were thus destroyed. Against migrating swarms of young grasshoppers such remedies as spraying with crude oil, kerosene emulsion, or a strong tobacco solution gave satisfactory results.

The wireworm enemies of corn and cotton received considerable attention at the South Carolina station. In cases of infestation by *Horistonotus uhlerii*, the best protection was found in a well-planned rotation in which the soil is not disturbed during the egg-laying period. It appears that the female beetles will not burrow for egg-laying purposes in compact soils or in soils which have a crust formed on the surface. Deep plowing during the pupation period, from May 15 to July 15, is particularly effective. For the control of *Monocrepidius vespertinus* fall and winter plowing is recommended, for the reason that the larva seldom burrows deeper than 4 inches.

The Florida station continued its study of the woolly white fly. It appears that this pest is rapidly spreading through the citrus districts of the State. Ordinarily the woolly white fly does little damage, but in severe outbreaks it is capable of causing an almost total loss of crop. Miscible oils were found effective against the early stages of the larvæ. Moreover, both the red and brown fungi have been found growing to some extent on this pest. The woolly white fly is also heavily parasitized by a minute hymenopterous insect which assists greatly in its control.

The red spider received much serious attention at the Oregon station. Careful studies were made of its life history with reference to the bearing of this information on rational methods of control. It appears that preventive measures are more important than direct attempts at control. To this end it is recommended that useless host plants of the red spider be destroyed, that clean culture be scrupulously practiced, and that a rational system of crop rotation be adopted. Spraying and fumigation appear to be of little value in controlling this pest.

In a study of the various arsenates of lead at the Oregon station a reliable method was devised for the preparation of pure lead hydrogen arsenate. A new basic lead arsenate of apparently constant composition was also produced. Many difficulties have been encountered in making an accurate determination of the solubility of arsenical compounds on account of the impurity of the materials used in such experiments. Field tests in which pure arsenates were used in strengths as high as 8 pounds to 100 gallons of water showed no injury to foliage. The Virginia station also made a study of lead arsenate with reference to the amount of arsenic in solution when lead arsenate is added to different spray solutions. It was found that sodium and potassium sulphids dissolve more arsenic when mixed with lead arsenate than do the commercial lime and barium-sulphur spray solutions. When arsenate of lead is added to solutions of sodium sulphur or potassium sulphur a large percentage of arsenic goes into solution. In fact, in all the sulphur spray solutions the amount of soluble arsenic is increased.

The Michigan station has attempted to determine the exact mechanism by which contact insecticides kill. In this work it was found that reductases, catalases, and oxidases occur in water extracts of various insects, and evidence was obtained that these enzyms exist in the living tissues of insects. Some of the insecticides with which experiments were made, notably gasoline, carbon bisulphid, hydrocyanic-acid gas, and sodium fluorid, when used at a concentration sufficient to kill insects, injuriously affected the activities of the enzyms. The effect of the insecticides upon the enzyms was somewhat unequal, and the normal balance of their activities was thus disturbed. Since these enzyms are held to be of importance in the respiration of insects, any disturbance in their activities would appear to prevent the normal absorption of oxygen. It was found that fat tissues absorb gasoline vapor and certain other gaseous insecticides, thus rendering the membranes less permeable to oxygen. In experiments with insecticides which do not spread readily upon the surface of leaves or bark the Michigan station found that the spread of insecticides is largely a function of the surface tension of the liquid. In experiments in the laboratory and subsequently in the field a number of substances were used for the purpose of lowering the surface tension. It was found that extracts from the stem and leaves of *Saponaria officinalis* gave the best results. When extracts of this plant were added to lime sulphur the solution spread almost as uniformly as in oil.

HORTICULTURAL INVESTIGATIONS.

The general problem of orchard management has been made the subject of study at several of the stations. At the Indiana station a project of this sort is in progress. Weekly records are being kept of the temperature of the air and the soil, of rainfall, and various other classes of data regarding the growth of trees in height and circumference and regarding the time of flowering and fruiting. Soil moisture is determined at a depth of 9 inches four times during the season. The lowest percentage of soil moisture was found in plats kept under sod, and the highest in straw plats. A heavy application of a complete fertilizer showed no effect on the conservation of moisture in the soil.

Studies in fruit-bud formation were carried on at the New Hampshire station. It appears that the yield of Baldwin apple trees in off years can be materially improved by good cultural methods. Axillary fruit buds on the current season's growth seem to be a not uncommon habit with the Baldwin and several other varieties of apples. No relationship was traced between the rainfall of the growing season and the formation of fruit buds. The trees which received clean culture or cultivation with cover crops showed a greatly increased capacity for fruit-bud formation. The use of fertilizers in addition to cultivation, however, appeared not to increase the number of fruit buds.

In a study of heredity in melons at the New Hampshire station attention was given to form of fruit, color of skin, size of seeds and of fruits, and ribbing and netting of the skin. In this work it was found that yellow color of the skin was dominant over green color, round form of fruit over oblong form, and ribbing of the fruit over nonribbing. At the North Carolina station experiments in breeding rotundifolia grapes indicated that the sexes in the seedlings of this type of grapes are equally divided, that the colors in rotundifolia grapes behave as Mendelian characters, and that seedlings of either white, red, or black color can be produced at will. It appears also that white color is recessive to all dark colors and that black is dominant over red.

The Minnesota station made a study of pollen development in the grape as connected with sterility. It was found that while many varieties of American grapes are unfruitful when self-pollinated, cross-pollination secured by mixing the varieties at planting time successfully overcomes this sterility. In the grape sterility appears to be due to the pollen rather than to the pistil. As a result of this study it was concluded that since both fertile and sterile hybrids occur among the cultivated varieties of the American grapes, hybridization is not necessarily a cause of sterility. Apparently sterility in grapes can not be overcome by cultural methods, but only by mixing the varieties in the vineyard at planting time.

At the West Virginia station an elaborate study of the pollination of the apple is in progress. In this work the Rome Beauty, which is apparently self-sterile, was pollinated with six or eight other varieties. It was found that Rome Beauty pollen would germinate in a stigmatic extract of the same variety, but that when the pollen was placed on a stigma of the same variety it seemed to cause a hardening of the stigmatic tissue. When, however, the pollen of other varieties was placed on Rome Beauty stigmas the tissue of the stigma seemed to soften in advance of the pollen tube, making possible a rapid penetration.

In studying methods for the better preservation of apples in storage under ordinary farm conditions the Vermont station experimented with sawdust, leaves, chopped hay, paper wrappers, and sand. Only sawdust, either from wood or cork, seemed to possess any value in preserving apples. All the different materials used kept the apples cooler, but most of them caused an impairment of flavor. Several kinds of protective dips were employed to determine their influence on the preservation of apples. Among these substances Bordeaux mixture proved the most effective, retarding decay and preserving the flavor of the fruit.

A study of hardiness in the apple as correlated with structure and composition is under way at the Iowa station. It has been demonstrated that a sudden drop in temperature is more injurious than the actual degree of cold. While all twigs not previously dried were

injured to some extent when held in a temperature of 10° F. for 20 minutes, the injury was considerably less in the hardier varieties. In the course of this work many indications of morphological differences between hardy and tender varieties of apples were found, but from a practical standpoint it is still impossible to name any one test by which the degree of hardiness of seedling apple may be foretold.

The rest period in plants has been made the subject of an elaborate investigation at the Missouri station. In the course of this work it has been found that bulbous plants have a decided rest period, which occurs in summer, and that ether and other agents which break the rest period of woody plants failed to do so in the case of bulbous plants. In a list of 65 species of herbaceous perennials transplanted in late fall after becoming dormant and treated in various ways to force them into growth, the only species which made any growth at all began growing in from one to three weeks. Frost, desiccation, and etherization appeared to be the most effective agents for breaking the period of rest. Similarly, in connection with woody plants, conclusive evidence was obtained that practically all woody plants have a rest period of longer or shorter duration. In the investigation of the rest period of woody plants 42 species were grown in pots and treated by freezing, drying, and etherizing. Some evidence was obtained that the rest period is associated with enzym activity. In a study of the seeds of 122 species of plants it was found that fully 75 per cent have a rest period. Seeds dried for a month germinated more quickly and in higher percentage than when planted immediately after the maturity of the fruit.

At the New York State station a study was made of the effect of ringing upon the productivity of apple, pear, plum, and cherry trees. It was found that ringing improves the growth of certain organs for a time, but devitalizes others, and that under certain conditions ringing may induce and possibly increase the fruitfulness of apples, but that it rarely has these effects on other fruits, the stone fruits being largely killed by the process. Even in the case of apple trees only the most vigorous trees would stand the operation. The results were in general decidedly unfavorable to the ringing of fruit trees as a farm practice. The New York State station also made a study of methods of treating pruning wounds. In this work white lead, white zinc, yellow ocher, coal tar, shellac, and various other dressings were tested. These experiments brought forth no evidence that it is worth while to treat pruning wounds of fruit trees with any of the substances which are in common use for that purpose. In the case of very large wounds it may be desirable to use covering, and in this case white lead is to be preferred.

INVESTIGATIONS OF PLANT DISEASES.

Several of the stations carried on an investigation of apple rust. At the Wisconsin station it was found that two or three applications in May with Bordeaux mixture, lime-sulphur, or lime-sulphur-copper mixture would greatly reduce the amount of rust, but it appeared that no amount of spraying would entirely prevent it. Spraying cedar trees was also found to be ineffective in checking the spread of the disease. The complete eradication of red cedars for a radius of a half mile or more from all orchards is considered the only sure remedy for controlling apple rust. A marked difference in susceptibility to the disease was noted in different varieties, the Wealthy being particularly liable to infection. At the West Virginia station it was shown that apple leaves are susceptible to infection of rust only when young, and that a destructive rust infection is not likely to take place after the first week in June. The meteorological conditions during this period are apparently of great importance in determining the extent of rust infection. It was found that the disease can be fairly well controlled by fungicide sprays, but that destruction of cedar trees is the only completely effective remedy. Likewise at the Virginia station apple rust received great attention. It was found that the apple-rust fungus may cause an increase of transpiration by preventing the closing of the stomata. The increased respiration thus brought about in the leaves of diseased apple trees may be a part of the explanation of the unthrifty appearance of such trees. Evidence was obtained that spraying for apple rust is an economic and reasonably effective operation, especially if the applications are combined with those required for other fungus and insect diseases. The eradication of cedar trees, or at least the destruction of cedar apples, is strongly recommended as a result of these experiments.

At the Colorado station a study was made of spur blight of the red raspberry. This disease was found to be due to a new species of fungus, which is described under the name *Sphærella rubina*. Chocolate-brown discolorations appear in the epidermis of infected canes, and the infection can be traced in nearly every case to a lesion on the petiole. The bark of the affected canes frequently splits longitudinally. Satisfactory results were obtained in controlling this disease by the use of an adhesive Bordeaux mixture.

Hop mildew received some attention at the New York State station. This disease has been of serious importance since 1909. Infection appears to occur during wet weather. It was noted that fresh mildew spots appear about 10 days after each rain. Several forms of sulphur were used in treating hop mildew, and rather satisfactory results were obtained. Under conditions of severe infection

only 5 per cent of unsulphured hops was free from mildew, while 78 per cent of the sulphured hops escaped infection.

A study was made of relative susceptibility of different cruciferous plants to clubroot at the Vermont station. A great range of variation in susceptibility was noted among varieties of cabbages, radishes, turnips, and other related plants. The soft, white-fleshed turnips seemed to suffer more than the firm, yellow-fleshed rutabagas. In this work 104 species, belonging to 28 genera, were examined. Incidentally it was found that the application of air-slaked lime at the rate of 150 bushels per acre would make possible a satisfactory yield of cabbage, where otherwise the crop was almost a total failure on account of the clubroot.

In continuing its experiments with methods of preventing grain smut the Indiana station made use of an automatic sprinkling device. After adjusting the flow of solution and of grain in this apparatus, the process requires no further attention except that of shoveling the grain into the hopper and of removing the moist grain from the floor to a suitable place for drying. The machine has a capacity of 100 bushels per hour and appears to be a very satisfactory device.

The Colorado station continued its study of yellow berry in wheat. It was found that this trouble could be much lessened or entirely prevented by applying to the soil a sufficient quantity of available nitrogen. The disease is increased or even greatly intensified by adding potash to the soil, while phosphorus has no apparent effect upon the trouble.

At the Vermont station a study was made of the organism of potato scab in the soil. It appears that this disease is chiefly spread through manure and humus rather than through scabby potatoes. The use of flowers of sulphur seems to be of some help in diminishing the amount of scab. It was also found that the potato-scab organism thrives best in neutral or slightly alkali soils and not in acid soil.

The fungus and bacterial diseases of the sweet pea received much attention at the Delaware station. It was found that this ornamental plant is subject to a number of diseases. Boiling the seeds for one or two seconds destroys the spores of parasitic fungi, but the treatment is not applicable to large quantities of seed. The same results may be obtained by soaking the seeds in sulphuric acid for five minutes or in a 5 per cent formaldehyde solution for 5 to 60 minutes.

The Michigan station made an investigation of the diseases of ginseng. Particular attention was given to black rot, damping off, and nematode troubles. A solution of formaldehyde at the rate of 1 to 80 in water and applied at the rate of 1 gallon per square foot of soil was insufficient to sterilize the soil, but 1 to 25 was quite effective. Damping off was checked by the same method of treatment. In pre-

venting the attacks of nematodes steam sterilization proved to be the only efficient remedy. This treatment cost about $10 per 1,000 square feet of soil.

The Louisiana station studied the comparative value of germicides for use in sugar mills. Formaldehyde was found to be superior to other germicides for disinfecting sirup tanks or for destroying microorganisms which cause the deterioration of sugars.

VETERINARY INVESTIGATIONS.

In the study of bovine tuberculosis at the California station, feces and throat swabs from 36 tuberculin-reacting cows were examined, with the result that 2 of the throat swabs proved to contain tubercle bacilli. In infected cows which showed no visible signs of tuberculosis no evidence was obtained of the presence of tubercle bacilli in the milk. Further experiments with the von Behring method of immunization against tuberculosis showed that the method is of no practical value and is positively dangerous.

At the Montana station the intradermal method of tuberculin test was tried with range cattle. This method appears to be equal in accuracy to any other method and is recommended as especially valuable in testing herds of range cattle. The Washington station studied the effect of continued injections of tuberculin upon tuberculous cattle. It appears that small weekly doses of tuberculin have an apparent therapeutic value. Moreover, the injection of constantly increased daily or weekly doses of tuberculin also showed some therapeutic effect.

In the study of hogs during the occurrence of hog cholera the Oklahoma station found that very great changes take place in the blood. The general tendency is toward a reduction of the red blood corpuscles and of the amount of hemoglobin as well as a lowering of the count of white blood cells. The introduction of virus into healthy hogs also had the effect of materially reducing the number of red blood corpuscles, but did not greatly affect the leucocytes.

At the Indiana station the virulence of the blood from hogs affected with cholera was tested at different periods in the disease. It was found that blood was more virulent when taken on the sixth or seventh day of the infection. The morphological changes in the blood corpuscles of affected hogs were carefully studied at the Arkansas station. It appears that an infection of hog cholera gives rise at an early stage of the disease to the appearance of numerous mononuclear or transitional leucocytes. After an inflammatory complication occurs polymorphic leucocytosis also appears. The evidence obtained during the work indicates that the destruction of red corpuscles is not a prominent feature of the disease.

The biology of the cattle tick has been thoroughly studied at the Tennessee station. It was found that the parasitic stages of the tick are little affected by changes in air temperature. The seed tick requires 7 to 9 days for engorgement, the nymphal stage 5 to 10 days, and the adult stage 4 to 14 days. The nonparasitic stages of the tick, on the other hand, vary greatly with season and temperature. For example, the oviposition period varies from 9 to 122 days under similar conditions.

The Wyoming station continued its study of the biology of the sheep tick and methods for eradicating this pest. The evidence thus far obtained indicates that if a second dipping be given 24 days after the first dipping all ticks will be destroyed. The evidence obtained in this investigation indicates that dipped sheep should be kept strictly separated from the undipped sheep and that precautions should be taken to prevent dogs or attendants from carrying the ticks from the undipped to the dipped sheep.

In consequence of an unusual outbreak of gapeworm infestation of fowls, the West Virginia station carried on some experiments in methods of controlling this worm. Satisfactory results were obtained from the use of creolin in the drinking water. For this purpose it was found that three drops of creolin per pint of water gave excellent results.

The treatment of chicken pox of fowls by the vaccination method gave excellent results at the Nevada station. A quantity of the pseudo-membranes from the mouths, eyes, and wattles of affected birds were collected, finely minced, mixed with sharp sterilized sand, and triturated for one hour in normal salt solution. The material was then macerated in an ice box over night, filtered through cotton, diluted with normal salt solution, and attenuated in a water bath at 55° C. for one hour. Within 18 days after the treatment was applied to a badly infested flock of fowls death losses had practically ceased, and within 40 days the outbreak of the disease was entirely checked. Similarly at the California station this method of vaccination was found to be entirely satisfactory in preventing the disease. In a badly infested flock 1,177 fowls were vaccinated, and only 9 per cent consequently developed the disease. The vaccination method also appears to have a curative effect. The Connecticut Storrs station has demonstrated the great practical value of the agglutination test in diagnosing white diarrhea.

The North Carolina station made an interesting contribution to the subject of cottonseed-meal poisoning. In this investigation cottonseed kernels were used in the place of cottonseed meal. From this material gossypol was extracted by the use of ether or gasoline. The crude product was further purified, and ultimately a crystalline product called gossypol acetate was obtained by precipitation with acetic

acid. It was found that gossypol was fatal to rabbits, either when given in repeated small doses or in one large dose. In connection with this investigation it was also found that gossypol forms an oxidation product which is nontoxic. In attempts therefore to devise a practical method to render cottonseed meal harmless attention was given to the problem of oxidating the gossypol content. It was shown that cottonseed kernels are rendered less toxic by the partial extraction of gossypol and nontoxic by the nearly complete extraction of the gossypol.

At the Mississippi station it was found that the poisonous effects which had been noted in stock which feed upon *Paspalum dilatatum* were due to the infection of this grass with a species of ergot known as *Claviceps paspali*. In a further study of the poisonous principles of water hemlock the Nevada station isolated cicutoxin from water hemlock and studied the chemical and physiological properties of this active principle. No antidote has been found for counteracting the poisonous properties of this plant.

INSPECTION OF THE STATIONS.

In accordance with the usual practice of the office, a personal inspection was made during the year of the work and expenditures of each of the experiment stations receiving Federal funds. This inspection served as the means of securing a large amount of first-hand information in regard to the progress of the stations and their relations to the colleges with which they are connected and to the agriculture of the States, and the opportunity was embraced for conferences with the station officers in regard to station organization and administration. This inspection was participated in by five members of the office force—the assistant director (E. W. Allen), W. H. Beal, Walter H. Evans, E. V. Wilcox, and J. I. Schulte.

The following reports upon the several stations are based on the results of this inspection, together with the annual financial statements of the stations, rendered on schedules prescribed by the Secretary of Agriculture, and the printed and other reports received from station officers.

ALABAMA.

Agricultural Experiment Station of the Alabama Polytechnic Institute, *Auburn.*

J. F. Duggar, M. S., *Director.*

Considerable improvement took place during the year in the organization and management of the Alabama station, and much progress was made in unifying and coordinating its efforts in different lines of work. There were several changes in the staff. Dr. F. L. Thomas

was appointed assistant entomologist and E. A. Vaughan succeeded J. W. Ells as field assistant in entomology. E. Gibbens was appointed assistant in beef husbandry and L. F. Pritchett assistant in veterinary science. The local experiment funds continued to be available to the station and enabled it to carry on much work in the practical study and testing of fertilizers for various crops.

Adams fund projects.—Breeding experiments with cotton, corn, and oats proceeded along the same lines as in previous years. A large amount of additional data was accumulated, but these data have not yet been sufficiently well assembled and digested to show their scientific bearing and value. A beginning was made in the computation of data bearing on possible correlations, particularly in the case of corn.

A study of the rice weevil as affecting corn was devoted chiefly to an investigation of varietal resistance, the relation of methods of culture, harvesting, handling, and storage to weevil injury, and the use of repellents, insecticides, and trap plats of early corn as a means of protection. This work was carried on at about 20 different places in the State. The work was to some extent a repetition of the work of the previous year, for the purpose of verifying the results with greater certainty. The study of factors governing the production, diffusion, and efficiency of hydrocyanic gas and carbon bisulphid was carried on largely in connection with the investigation of the rice weevil. No conclusive results were obtained in the study of the causes of the burning effects of lead arsenate. The cooperation of the chemical department has been secured in analyzing the materials used in this work.

The fertilizer requirements of soils for cotton, as determined by analyses of cotton plants grown upon them, received considerable attention, and a large mass of data relating to this subject was accumulated. These data were based largely on chemical analyses of plants grown to the 4-leaf stage in wire baskets and pots, and also upon field work with cotton. The results show a definite correlation between plant analysis and field results, the correlation being closer than that between soil analysis and field results. This was particularly true in the case of potash.

In the project on the effect of some southern feeds on the properties of lard an attempt was made, without success, to feed rations containing a large proportion of cottonseed oil, in some cases as high as one-third of the ration. Pigs did not thrive on this ration. Further evidence was obtained that peanuts, soy beans, and possibly velvet beans soften pork fats, while cottonseed meal hardens them, and attention was directed more definitely toward finding the cause of these effects. The cooperation of the chemical department was had in this work. A comparative study was made of the effect on hardness

of pork fat resulting from the use of cottonseed meal, raw cottonseed kernels, cottonseed oil, and other cottonseed products. Pork fats were hardened by cottonseed meal, but were softened by the oil and the raw kernals.

Studies on the storage and germination of potatoes were continued. The work is being directed toward the solution of the problem of keeping the spring crop of potatoes and of securing uniform and prompt sprouting of spring seed when used for fall planting. In this work 60-pound samples of potatoes were treated in various ways and planted or kept in the air to observe the effect on the keeping quality or the sprouting. The results are thus far inconclusive.

The investigation of the theory of antagonism, especially as applied to conditions existing in the soil, was concerned chiefly with the study of the effects of mineral toxic substances. These studies are being carried on with plants grown in quartz sand, in order to limit the number of complicating conditions. A preliminary paper dealing with the antagonism between heavy metals, particularly mercury, copper, and zinc, has been prepared for publication. Some progress was also made in the study of the toxic effect of certain organic substances found in soil. This work involves the determination of the toxins occurring in soils which received known treatments and a study of the effect of certain organic substances upon the rate of nitrification and the growth of plants. The substances used in this work included coumarin, vanillin, pyrogallol, dihydroxystearic acid, pyridin, quinolin, nucleinic acid, naphthylamin, and asparagin. The results obtained indicate in general that these supposed toxins do not show as high a degree of toxicity in soils as in water cultures.

Considerable progress was made in the project on leaf spot and fruit rots of peanuts. The symptoms of the leaf spot of peanuts were carefully studied. It appears that this fungus does not attack any other legume. The fungus apparently persists in a living condition throughout the winter in diseased leaves. Crop rotation and disinfection of the seed are recommended as preventive measures. The red-rot disease is characterized by bright red bodies on the brown, decaying shells. This fungus appears not to be strictly parasitic on peanuts. Inoculation with pure cultures has thus far given negative results. Another rot disease of the peanut is due to *Sclerotium rolfsii*, which lives in the soil and which causes the appearance of small brown bodies in the peanut kernels. Work on citrus canker included a study of the association of fungi and bacteria in this disease and methods of control by pruning and spraying.

Work with Hatch and other funds.—The station carried on a number of experiments with field crops, particularly wheat and corn. A review of experiments with wheat during the past 16 years showed that in productiveness Alabama Blue Stem wheat occupied first rank,

while Purple Straw, Red Wonder, Golden Chaff, and others followed in the order named. It appears that the earlier varieties of wheat are preferable under Alabama conditions. As a result of five years' experiments it appears that nitrate of soda, cottonseed meal, and cotton seed are of equal value as sources of nitrogen. In the fertilizer experiments carried on by the station it appeared that commercial fertilizers are more effective and profitable for cotton than for corn. Nitrogen, from whatever source, produced a fair increase in yield. Acid phosphate, used alone or in various combinations, also caused a small increase in yield of corn. Kainit was not very effective as a corn fertilizer. The best fertilizer combinations brought about an increase in the yield of corn, both on fertile and relatively unfertile soils. The fertilizer experiments with corn indicate that the largest returns are received from money invested in the purchase of nitrogen and that no economic returns can be expected from the application of potash to corn, especially with the present high prices of potash.

In connection with field experiments studies were made of the progress of nitrification in plats treated with different nitrogenous fertilizers, including dried blood, cottonseed meal, and calcium cyanamid. Examination of soil samples, taken every two or three weeks, showed a decided loss of nitrates in winter, and this loss appeared not to be due to leaching.

The department of plant pathology began an investigation of a leaf disease of walnuts and a rot disease of eggplant.

The horticultural department conducted some variety tests with various garden crops and made a study of sweet potatoes, particularly of seed selection, methods of bedding, culture, and fertilizers. A fertilizer experiment was begun for the purpose of devising a suitable method for renovating pear orchards affected by blight. Varietal and cultural studies were also conducted on pecans, grapes, peaches, figs, tomatoes, asparagus, cabbage, and Irish potatoes. In fertilizer experiments with sweet potatoes the largest increase in yield was brought about by phosphoric acid. All experiments indicated that nitrogen and phosphoric acid are more important for the growth of sweet potatoes than is potash. The use of highly nitrogenous fertilizers did not cause the plants to produce an excess of vines. On the whole, potash appeared to have very little effect on the growth of sweet potatoes.

The veterinary work of the station included experiments in feeding spoiled corn to mules to determine its relation to cerebritis, a study of the life history and methods of control of the kindey worm of hogs, an investigation of the effect of sneezeweed on horses and cattle, a study of osteoporosis in horses, and the manufacture of hog-cholera serum. Sneezeweed was found to be highly poisonous, but the active principle has not yet been isolated.

The entomological department made a study of the life history, habits, and methods of control of the fall army worm and also devoted much attention to the investigation of methods for controlling the boll weevil.

The publications received from this station during the year were as follows: Bulletins 177, Raising and Fattening Beef Calves in Alabama; 178, Boll-weevil Effect upon Cotton Production; 179, Wheat in Alabama; 180, Leaf Spot and Some Fruit Rots of Peanut; 181, Local Fertilizer Experiments with Corn in South Alabama in 1911, 1912, 1913, and 1914; 182, Local Fertilizer Experiments with Corn in North Alabama in 1911, 1912, 1913, and 1914; 183, Irish Potatoes; 184, Local Fertilizer Experiments with Sweet Potatoes; Circulars 21, Boys' Pig Clubs, 22, Alabama Boys' Corn-club Day—I, Program Outlined and Amplified; II, Constitution, By-laws, and Other Essentials; 23, How to Organize and Conduct a Girls' Canning Club; 24, Information on Corn Growing for Corn-club Boys; 25, Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1913; 26, Silos and Silage; 27, Citrus Canker; 28, The Oak Scale and Its Control; 29, Bur-clover Seed, Means of Hastening Their Germination; 30, Program of County Organization Day for Boys' Corn Club; 31, Annual Report of the Director of the Experiment Station on Work Done Under the Local Experiment Law in 1914; 32, Fly Baits; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	29,738.46
Farm products	379.13
Miscellaneous	3,323.53
Total	63,441.12

With the support of the local experiment funds the station is able to carry on much work of a practical nature, which serves, incidentally, to put the members of the staff in closer touch with the farmers of the State. The experiments which the station has carried on with reference to the wheat and oat industry have led to a greatly increased production of these cereals in Alabama.

ALASKA.

Alaska Agricultural Experiment Stations, *Sitka*, *Kodiak*, *Rampart*, and *Fairbanks*.

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The climatic conditions during the short growing season in Alaska are important factors in determining the prosperity of agriculture. During the year the weather conditions were unusually favorable

along the coast, the rainfall being light and the amount of sunshine considerably more than the average. In the interior of the Territory the clear weather and light rainfall, however, brought about conditions approaching a drought. Nevertheless, most cereals and other crops produced a satisfactory yield. The spring was much earlier than is commonly the case throughout the Territory.

At the Sitka station a new propagating house, especially adapted to Alaska conditions, was erected. Plant-breeding work was continued, particularly with strawberries, raspberries, currants, apples, and roses. The numerous hybrid strawberries which have been originated at the station are still under test. Careful notes have been collected on the performance records of these hybrids, and selections will be made for further distribution. Both raspberries and strawberries fruited about a month earlier than the customary time at Sitka. More than 4,000 fruit trees and fruit bushes were distributed to farmers during the year, and a similar distribution was made of strawberries, horseradish, and rhubarb.

At the Rampart station the season was sufficiently advanced for seeding in early May. The amount of moisture in the soil, however, was somewhat limited, and for this reason the straw of most cereals was shorter than usual. Notwithstanding the shortness of straw, a fairly satisfactory yield of grain was obtained. Winter rye produced an excellent crop. Most of the varieties of winter wheat, however, failed in part. No variety of winter wheat has been found which will endure the winter well at Rampart. The only variety of alfalfa which came through the winter in good condition was *Medicago falcata*. *Trifolium lupinaster* and *Vicia craca* wintered over in perfect condition, and the former produced a good crop of seed. It has never suffered seriously from the winter climate. Hybridizing work with grains and varieties of alfalfa has been continued. T. D. Crippen was appointed as assistant at the Rampart station.

At the Fairbanks station the drought conditions were somewhat more serious, and grains as well as other crops produced only a medium yield. The cereals suffered most on the south slopes of the hills. Alfalfa grew very slowly, but began setting seed in July. Gratifying success was obtained in the production of Petrowski turnip seed. This turnip is apparently the most satisfactory one for Alaska, and the seed will be widely distributed. The yield of potatoes, particularly on the north slope of the hills, was satisfactory, while the hay crop was somewhat under the average.

At the Kodiak station there was also an early spring, but the dry season later in the year somewhat curtailed the growth of hay and silage crops. The herd of cattle did well during the year, and no disease appeared. The only trouble incurred with the flock of sheep was from the attacks of bears, which have become unusually numer-

ous in the neighborhood of the station. Further experiments were made in the application of fertilizers, particularly nitrate of soda, to the volcanic ash. Poor success was had in seeding grasses and clovers on this ash, for the reason that the high winds during the dry season carried away the light ash, thus exposing the roots of the young plants. L. Kelly resigned during the year and H. E. Pratt and J. C. Laney were appointed as assistants at the Kodiak station.

The expense of caring for the cattle at the Kodiak station is somewhat increased by the fact that the dairy work and buildings are located at the town of Kodiak, while the breeding herd is maintained on the reservation adjoining Kalsin Bay. As soon as the funds will permit it is expected that buildings will be erected at Kalsin Bay for the convenience of an assistant and the necessary herdsmen.

The large influx of homesteaders and settlers in the Matanuska and Susitna Valleys makes it desirable to establish a station in that region. A suitable site for the station has been selected and the development of the station and work in connection with the settlers in that locality will be begun as soon as funds are available.

The only publication of the station for the year was the annual report.

The income of the station during the past fiscal year was as follows:

United States appropriation	$35,000.00
Sales, including balance from previous year	7,823.11
Total	42,823.11

The Alaska stations have been the chief and almost the only factor in the rather remarkable development of Alaskan agriculture. Their work has necessarily been largely of a pioneer nature, and in carrying it on the stations have come into close contact with the farmers in all parts of the Territory.

ARIZONA.

Agricultural Experiment Station of the University of Arizona, *Tucson.*

R. H. Forbes, M. S., *Director.*

The new agricultural building (Pl. II, fig. 1) was completed, at a cost of $165,000. This building contains offices and laboratory rooms for all departments of the station work, for college class work in agriculture, and for extension work. In the patio of the building an audience room is provided with a capacity for 1,600 persons. A new farm of 160 acres was purchased in Salt River Valley at a cost of $30,000. This farm is expected to furnish facilities for experimental work in irrigated agriculture. The dry farm at Cochise was increased by the addition of 40 acres of land, bringing the total area up to 160 acres.



FIG. 1.—NEW AGRICULTURAL BUILDING ERECTED AT A COST OF $165,000, ARIZONA UNIVERSITY AND STATION.

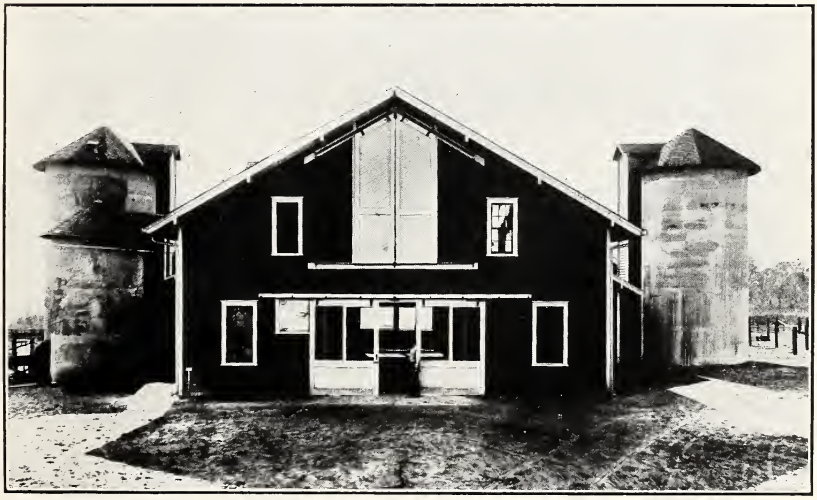


FIG. 2.—DAIRY BARN ERECTED IN 1915 FOR EXPERIMENTAL WORK AND TEACHING PURPOSES, FLORIDA STATION.

W. H. Lawrence, horticulturist of the station, resigned to accept a position at Missouri University and Station, and S. B. Johnson was appointed assistant horticulturist, R. H. Williams professor of animal husbandry, and W. S. Cunningham assistant animal husbandman. The organization of the extension service relieved the station staff of much work of an advisory nature with which it had previously been burdened. The State appropriation for the use of the experiment station during the year was $27,400.

Adams fund projects.—In the project on factors determining hardiness in spineless cacti attention was confined chiefly to 10 or 12 varieties which seemed to be promising. Observations were made on their resistance to freezing. The plants are examined at various periods of growth to determine the nature and amount of storage material and the thickness of the epidermis. There appeared to be a definite correlation between the thickened epidermis of certain varieties and their resistance to freezing, as well as between the amount of reserve material and frost injury. An attempt is being made in the study of these cacti to determine whether frost resistance is transmitted or is merely an individual characteristic.

In the study of the toxic effects of copper compounds on crops a large mass of data has been accumulated and is being prepared for publication. Chemical studies have been made of the roots of many species of plants under greenhouse conditions and in the field, and a general investigation of poisoning by copper of all the standard field crops has been carried on. Contrary to earlier observations, strong indications were obtained that under certain conditions toxic effects due to copper alone may be observed in the irrigated district which is under study.

In the investigation of underflow waters the work was extended to the Sulphur Spring Valley, where a State artesian well gave opportunity for investigation. Surveys were started near Casa Grande and in the vicinity of Florence. In the lower Santa Cruz Valley evidence was obtained that previous estimates of available underflow water were far too high. A systematic attempt is being made to determine the annual rate of recharge of underground reservoirs.

In connection with this work a study was made of various types of pumps and engines to determine their efficiency for use by ranchers. This work led to the conclusion that the farmer should give up gasoline as a fuel for pumping engines in favor of low-grade distillates. It was found that 4-cycle gasoline engines with electric ignition and suction fuel feed could be successfully modified to burn heavy distillates. Distillates with a low flash point gave excellent results. It was found that gasoline engines already in service could easily be altered for using distillates by replacing the fuel mixer and the

exhaust block with others specially designed for the purpose. Four-cycle oil engines with electric ignition proved to be quite as reliable as gasoline engines. The cost of pumping on a 40-foot lift varied from $8 to $20 per acre, and on a 100-foot lift from $20 to $40 per acre.

Encouraging progress was made on all of the plant-breeding projects. The work in breeding alfalfa consists in line breeding with several hundred races, from which extensive eliminations will be made, using only a few desirable types. About 30 strains were under observation in small plats during the year. Data were recorded on their comparative value for forage production, and also on the water requirement and sap density. In the continuation of the work on breeding beans attention was given chiefly to races of white teparies, and a second selection was made of white races of these beans on row planting. One strain was obtained that gave an increased yield of 10 to 15 per cent. In the continuation of the wheat-breeding project the seond generation of selections of known varieties was under study.

Striking practical results were obtained from the investigation in corn breeding. Two types of sweet corn of unusual merit were obtained. These are being crossed, and comparisons are being made with standard varieties. A special effort has been put forth to determine the reason for the greater hardiness of some races of Papago corn. A great variation in the yield of different strains of Papago sweet corn was observed. In rows of the same length the yield varied from 8 to 145 ounces. This gave opportunity to select for a better form of ear and kernel and also for improvement in yield. The work has been carried on since 1911. In the fall of that year 61 ears were selected, and in 1912, 31 ears. Selections were continued during the years 1913 and 1914. During this time the average size of the ear and the average yield per stalk were considerably increased. As compared with the standard eastern varieties of sweet corn, the Papago sweet corn showed a uniform superiority. All the eastern varieties except three failed almost completely, and the best eastern variety was outyielded more than fourfold by the Papago sweet corn.

The project on the ripening of dates was completed. This work had been carried on for a long time and had involved a considerable variety of chemical and physical studies. It was found that by properly regulating the heat and moisture conditions and by stimulating the ripening process by means of such vapors as carbon dioxid and nitrous ether it is possible to prepare for market varieties of dates that do not ripen successfully on the tree in the Arizona climate. It was also shown that fruit can be placed on the market in a more sanitary and otherwise more satisfactory condition by pasteurizing the ripening fruit and packing it in crates lined with muslin.

Work with Hatch and other funds.—The division of botany gave considerable attention to plant introduction, some of this work being carried on in cooperation with the Department of Agriculture. Experiments were begun on the problem of developing native varieties of walnuts, currants, and various ornamentals. A native species of currant of great productiveness and fair quality has been found to be adapted for cultivation in any part of the State. Work with walnuts has shown that improved varieties may be successfully grafted on native Arizona stock. A general bulletin on this subject was prepared, giving the results of work on this line at the station and also on the farms of walnut growers.

Work was continued on methods of range improvement and upon the flora of Arizona. Along this line a beginning has been made in the preparation of four bulletins on the native cacti, the trees, grasses, and forage plants, and native and introduced shrubs.

In the animal-husbandry department experiments were begun in the breeding of ostriches. In this work attention is being given to the influence of breed, feed, individual, and other factors on the production and quality of feathers. The data obtained from sheep-breeding work at Phoenix were partly compiled and digested. It appeared that the characteristics of the crosses had not been well fixed. It is expected that the data will indicate for each cross whether any hardiness has been developed as indicated by the death rate among lambs. Studies were also continued on the effect of crossing upon the characters of the wool. It was found that the kemp of the Tunis breed disappeared in the second generation of crosses with the Hampshire breed. In dairy work particular attention was given to the use of supplements for alfalfa hay in milk production and to a comparison of beet pulp with rolled barley.

The horticultural department made studies on a variety of problems, including observations on the fruit and leaf characters of different fruits grown at the station and cultivation of grapes and figs. It is expected that the data obtained in this work will soon be published as a bulletin of the station.

In the agronomy department progress was made in the study of potato production in Arizona. In this work the questions of varieties, the time of planting, and methods of storing were considered. The cereal work of the station included the study of the milling quality, rust resistance, and yield of wheat, oats, barley, rye, emmer, and spelt. Variety tests were conducted with corn and sorghum. An experiment was begun with Sudan grass for the purpose of determining the best time of planting, the water requirement, extent of production of forage and seed, and the possibility of growing Sudan grass with leguminous crops. Variety tests were also carried on with Indian strains of corn obtained from many localities in the

Southwest. Cultural and variety studies were also begun with sugar cane.

The following publications were received from this station during the year: Bulletins 71, Gasoline Engine Troubles and the Care and Operation of Gasoline Engines; 72, Agriculture of Sulphur Spring Valley, Arizona; 73, Alfalfa in the Southwest; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	29,306.56
El Paso & Southwestern Railroad	297.33
Farm products, including balance from previous year	5,980.20
Total	65,584.09

The Arizona station has maintained its active and aggressive efforts in the interest of the various agricultural industries of the State. Its physical equipment was added to during the year, and the further organization of the extension service relieved the station workers more completely from interruption in that line, leaving them free for research in connection with local problems, in which noteworthy progress has already been made.

ARKANSAS.

Arkansas Agricultural Experiment Station, *Fayetteville.*

MARTIN NELSON, M. S., *Director.*

Conditions at the Arkansas station were disturbed during the year by financial uncertainties and complications. The State appropriation to the station for the coming biennium was quite generous, but the governor exercised his authority to reduce certain items in the appropriation bill by cutting out appropriations for substations and for most other purposes. A portion of the Adams fund work, particularly with cotton, is carried on at the substations, and this work was therefore affected. Shortage of funds was felt in every department of the station, and the situation was made more acute by the financial condition of the university.

Improvements at the station during the year included the equipment of a soil laboratory for research work, repairs in the laboratories of plant pathology and bacteriology, and the erection of new pens and inexpensive buildings for use in connection with hog-cholera work. H. E. Dvorachek succeeded W. L. Fowler as animal husbandman, and H. A. Sandhouse was made assistant animal husbandman, vice D. H. Branson, resigned. Dr. R. R. Dinwiddie, for many years veterinarian of the station, resigned on account of ill health, and an assistant, C. L. McArthur, was appointed in his place.

Adams fund projects.—The project on the organism of pear blight was continued. In this investigation the true *Bacillus amylovorus* was isolated during the previous year, and evidence has been obtained that two or three other organisms are involved in pear blight. These organisms are receiving considerable attention. Obstacles were met in making pure cultures of them, but these difficulties have now been largely overcome by laboratory improvements.

The study of a new disease of apple trees has been under way since 1911. A persistent search has been made for the causal organism. The disease appears to be generally distributed throughout the apple orchards of the northwestern part of the State. Thus far all attempts to find the pathogenic organism have failed. Incidentally, in connection with this work, a large number of observations were made on the distribution of the disease in different parts of the State, and a study is in progress to learn the possible relation between soil type and the prevalence of the disease. The histological changes produced by the disease in infected trees have been carefully studied.

The investigation of the relation of hog cholera and swine plague bacilli to contagious diseases of hogs was further developed along two lines: Diagnosis of the disease and standardization of antiserum, and the method of immunizing hogs against the disease by means of serum-free blood cells attenuated by heat or other means. In devising methods for diagnosing the disease agglutination and complement fixation tests have been used. It appears that agglutination with swine-plague bacillus is of no value as a diagnostic agent for hog cholera. Some attention has been given to the preparation of an antigen to be used in the complement fixation test, but no success has attended these efforts. The attempt to secure an attenuated virus under the influence of heat was without satisfactory result. The virus either lost its virulence entirely or caused a chronic form of hog cholera when injected into hogs. A great difference was found in the susceptibility of pigs to hog cholera. All observations thus far made indicate that every pig which recovers from treatment is immune. The greatest success in attenuation was obtained by passing virulent blood through a series of pigs for eight days, injecting the blood into one pig and withdrawing blood from this pig and injecting it into another on the following day. Elaborate studies were also made of the morphological elements of the blood of normal and infected hogs.

In the project on woolly aphis of the apple Northern Spy trees were tested as to their immunity to attacks by this insect. The Northern Spy stock used in this experiment was obtained from Australia and California. Several varieties of apple have been grafted upon Northern Spy roots and crab-apple roots. The life history of the woolly aphis was pretty thoroughly worked out for Arkansas

conditions, and some work was done with reference to the other host plants of this insect. The insect apparently winters over in the larval stage in Arkansas. The connection of the woolly aphis of the apple with that of the elm was not definitely determined. Difficulty was experienced in obtaining material for further study of the round-headed apple-tree borer. A badly infested orchard was found toward the close of the year, and in this orchard the life history of the insect will be followed systematically during the coming season.

In connection with the project on xenia in apples an orchard about 10 miles north of Fayetteville was leased by the station. The original aim was to secure varieties that would fertilize the Mammoth Black Twig. At present the work includes a study of the influence of cross-fertilization on size, color, weight, shape, yield, flavor, aroma, and texture of the fruit. Nearly a thousand pollinations were made, using the Winesap as the female parent, and large numbers of crosses were made with Ben Davis, Jonathan, and Grimes Golden apples.

The project relating to losses of soil fertility in fruit growing was practically completed during the year. The project has been under way for nine years. The original peach trees are all gone, and, while some of the apple trees are left, they show a lack of uniformity, and it is thought that the results already obtained are all that can be expected from the project. The apple tree was found to change very little in composition as it grew toward maturity. During the nine years' work on the project 18 trees of each of five varieties of apple and 18 trees of each of two varieties of peach have been analyzed.

The study of the effect of the conditions of harvest and storage on the vitality of cotton seed was continued at an oil mill and also on a farm near Fayetteville. Temperature records were taken of the cotton stored under different conditions. No elevation of temperature in a wagonload of cotton over night, and no damage to the cotton or seed occurred when stored in units of one bale up to January 1. Seed stored in large quantities at the mill, however, showed a rapid rise in temperature. Heat darkens the kernels. It is planned to study the changes in unginned cotton when stored in quantity. The work connected with the cotton-breeding project was carried on chiefly at the branch stations. This work has involved the study of the inheritance of fruit characters in cotton hybrids, variations within commercial varieties as caused by soil or climatic conditions, and the effect of the selection of seed of long-staple cotton, grown continuously under conditions most suitable for upland cotton.

Work with Hatch and other funds.—At the branch stations variety tests with cotton were carried on, during which elaborate records were kept of the plant and crop. Variety, cultural, and breeding experiments were conducted at the main station on corn, wheat, oats,

barley, cowpeas, soy beans, sorghum, peanuts, alfalfa, clover, and grasses. An effort is being made to learn the degree of adaptability of various pasture and meadow crops to special types of soil and to particular localities. Fertilizer experiments included simple tests to determine possible deficiency of certain soils in humus, phosphoric acid, and potash. Prolific and single-eared varieties of corn were compared on land of high fertility. Cooperative work with farmers is also under way in a study of Sudan grass, corn, and oats.

In connection with the soil survey a study is being made of acid types of soil from various parts of the State, and the lime requirements of these soils will be determined by pot experiments. It was shown that oats make the best growth when planted on deeply plowed land. The largest yields were obtained from seeding at the rate of from 10 to 12 pecks per acre. In wheat experiments it was shown that early seeding makes possible a stronger root system, and that the use of the grain drill will insure a yield of nearly 4 bushels more than broadcast seeding.

The feeding value of cottonseed hulls and silage for dairy cows was the subject of experiment. The value of rice by-products for hogs was compared with that of corn. It appears that 100 pounds of rice polish is equal to 133 pounds of corn chops. The largest daily gains were produced by the use of combined rations of corn chops, rice polish, and rice bran. A comparative test was begun of the merits of various breeds of poultry in egg production.

Little work in plant pathology was done under the support of Hatch funds. Some attention was given to bitter rot of apples and to the troubles experienced by tomato canners as the result of diseased tomatoes.

The veterinary department, in addition to its Adams fund work, published observations which have been accumulating for some time on tick eradication in Arkansas. Some work was also done in an investigation of remedies for contagious abortion and in studying the curative properties of hog-cholera serum and the immunity of suckling pigs to hog cholera. An attempt is being made to determine the stage in the progress of a case of hog cholera after which serum treatment is no longer of avail.

In connection with the Adams fund project on the life history of the round-headed apple-tree borer a number of tests were made of different compounds for the purpose of determining their value in preventing infestation by this pest. The remedies included asphalt, white lead, and wrappings of wire, cloth, etc.

The horticultural work of the station included a variety test of grapes, in which 143 varieties were used, and cultural experiments with strawberries, potatoes, asparagus, and sweet potatoes. In the potato experiments 69 varieties were tested. A bulletin was pub-

lished containing the practical observations of the horticultural department on the subject of strawberry growing.

The following publications were received from this station during the year: Bulletins 117, The Significance of Bacterial Infection in Hog Cholera; 118, Oats; 119, Tick Eradication in Arkansas; 120, Studies on the Hematology of Normal and Cholera-infected Hogs; 121, Report of Cultural and Variety Tests with Wheat; 122, Strawberry Growing in Arkansas; Circulars 21, Tomato Diseases; 22, Testing Cottonseed for Germination; 23, The Arkansas Dilution Table for Lime-sulphur Compound; 25, Hog Cholera; 26, Handbook on Diversified Farming; and 27, Boys' and Girls' Demonstration Club Work in Arkansas.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	15,309.84
Farm products	821.29
Miscellaneous	685.69
Total	46,816.82

The Arkansas station is doing a good amount of work for agriculture in the State, but it still lacks the certainty of adequate financial support. The station staff is working earnestly and diligently and is directing its attention to live problems, but the failure of State appropriations has made the future outlook less encouraging.

CALIFORNIA.

Agricultural Experiment Station of the University of California, *Berkeley*.

T. F. Hunt, D. Agr., D. Sc., *Director*.

During the year it is estimated that about one-fourth of the State funds appropriated for the maintenance of the college of agriculture of the University of California as a whole were used to support the various projects carried on by the experiment station. The sum which was thus available for supplementing Hatch and Adams support was about $124,000. A decision was reached regarding the site for the citrus station at Riverside, Cal. The area of land which was selected contains 465 acres, and of this amount about 350 acres are tillable. The development of this tract for experimental purposes will require the work of several years and increased appropriations, but an active start has been made toward fitting up the substation for the experimental work on citrus fruit for which it is especially well adapted. Several new appointments were made to the staff of the experiment station, including J. B. Davidson in agricultural engineering, W. P. Kelley in agricultural chemistry, H. S. Reed in plant physiology, and many other minor positions.

All the experimental work of the station was placed on a project basis, and the policy was adopted of discouraging the undertaking of new projects by any department until some of the old ones have been completed or abandoned for adequate reason.

Adams fund projects.—The general project on soil bacteria under arid conditions was carried on actively, and satisfactory progress was made on all of the various phases of this project. These studies are carried on with soil columns, cylinders, plats, and greenhouse facilities. Investigations in various districts of the State indicate that in many instances, at least, diminished yields and abnormal growth of plants, such as mottle leaf in orange trees, little leaf in peach trees, etc., is due to the inability of the plant to secure and assimilate nitrogen. Evidence has accumulated that this lack of growth or abnormal growth may be due not to the total lack of nitrogen but to conditions unfavorable to nitrification in the soil. Nitrate of soda in the experiments so far conducted has proved to be a relatively inefficient carrier of nitrogen when applied to citrus orchards. Organic nitrogenous fertilizer and sulphate of ammonia gave better results. It was also found that the percolation of alkali salts through some of the clay loam soils might so puddle the soils as to render them practically impervious to air and water. Evidence was obtained that an alkali salt in toxic concentration might be rendered harmless to the growth of plants or of soil bacteria by the addition of other salts, thus balancing to some extent the soil solution.

In the project on the artificial immunization of cattle against tuberculosis particular attention was given to a study of the means of transmission of tuberculosis, the resistance of animals to the disease, and more precise methods of diagnosis. A special effort was made to determine the value of the physical examination of cattle as a means of controlling the spread of tuberculosis. From the evidence thus far obtained it appears that the best practical program for controlling tuberculosis consists in isolating the calves, feeding them on boiled or pasteurized milk, and eliminating all mature animals which show physical signs of the disease. The attempt to eradicate tuberculosis by tuberculin testing and the slaughter of all reacting animals is considered an impracticable method. Constructive legislation concerned primarily with calves is recommended. The immunization method recommended by Von Behring and modified by other investigators in this country proved to be not only without value but positively dangerous. In the case of 36 cows which had reacted to tuberculin, tubercle bacilli were obtained in two cases in throat swabs, but in no case from the milk or feces.

Considerable progress was made in the project on the nature of certain physiological plant diseases, carried on by the department of plant pathology. In this work attention was given chiefly to curly

top of sugar beets, little leaf of peach, and mottle leaf of citrus trees. The growth of sugar beets has been clearly checked in many localities by a disease known as curly top, which is apparently associated with a small species of leaf hopper. Evidence was accumulated that this leaf hopper is concerned in carrying from plant to plant the organism which causes the disease.

The further study of the toxicity of insecticides has brought evidence that while fumigation with hydrocyanic-acid gas is the most practical method for control of scale insects on citrus trees, complete eradication of these pests is impossible on account of their physiological variation in susceptibility to the action of the gas. A small percentage of individual scale insects survive on each tree under the application of any dose of gas which it is safe to apply. Restricted localities in certain districts seem to show a higher percentage of resisting scales, but no apparent explanation of this phenomenon was offered. The study of this problem also showed that hydrocyanic-acid gas actually exerts a stimulating effect upon the eggs of scale insects if an underdose of fumigation is applied. In connection with this work questions regarding gas leakage from fumigation tents and the dosage required were investigated. Incidentally it was found that sodium cyanid has almost completely superseded potassium cyanid for insecticide purposes.

The study of Nicotiana hybrids begun several years ago by the botanical department was actively continued. A large mass of data was accumulated from a detailed study of several hybrid generations. An attempt is being made to determine the causes of sterility in certain tobacco hybrids. This work was quite largely supported during the year by other funds, and it is proposed to carry it on hereafter without the aid of the Adams fund.

Work with Hatch and other funds.—The California station carried on experimental work at Berkeley, Riverside, Whittier, El Centro, Fresno, Davis, and elsewhere. At Riverside the work is supported wholly by State funds. About 40 projects are being actively prosecuted. The chief work during the year included experiments with fertilizers for citrus trees, a study of leguminous cover crops, citrus variety tests, orchard heaters, insect pests, and fungus diseases of citrus, influence of various factors on the composition of fruits and nuts, fumigation methods, etc. In plant pathology particular attention is being given to root diseases and heart rot of lemon trees. A study was begun of the effect of nitrate of soda on soils in citrus groves. Experiments were started in breeding walnuts for the purpose of obtaining, if possible, strains resistant to walnut blight.

At Whittier a large amount of analytical work was done on citrus fruits grown on the fertilizer plats at Riverside. Determinations were made of the acidity and nitrogen. Thus far no definite correla-

tions have been found between the kind of fertilizer used and the character of the fruit. Investigations were also undertaken to obtain resistant varieties of stone fruits. The cottony rot of lemons was studied, and it was found that this fungus attacks a number of other species of the citrus family. A beginning was made in a study of the possibility of securing strains of citrus trees relatively resistant to nematode worms.

Rapid progress was made in a continuation of soil-survey work in cooperation with the Bureau of Soils of the Department of Agriculture. The survey of the Sacramento Valley covered over 6,000 square miles. The investigation of California soils by the study of deep-soil columns was nearly completed, and this work is expected to form the basis of a monograph of California soils to be published later. A study of nitrogen fixation by green-manure plants was continued with promising results. Inoculation experiments with lima beans were also carried on. In this work the yield was found not to be appreciably affected by inoculation and liming. A study of the nitrogen and organic matter in the sludges from septic and Imhoff tanks was made with the result that this material was found to be of considerable value for fertilizer purposes.

The veterinary department carried on work in serum manufacture, roup, chicken pox, hog cholera, mange in pigs, and skin diseases of horses. A thorough test was made of the method of vaccination against chicken pox which had been devised by the Wisconsin station. This method was found to be simple in application and exceedingly effective.

The miscellaneous experimental work of the entomological department included studies of the life history of cutworms and grain insects, especially the weevils, the relation of moisture to infestation, and practical means of controlling these pests.

The general work of the department of plant pathology, in addition to its Adams fund project, was conducted largely in connection with an investigation of the root rot of orchard trees caused by Armillaria. An investigation was also made of a bacterial disease of olives, a disease of nursery stock due to Pythiacystis, and a form of peach blight due to *Coryneum beijerinckii*. The bacterial disease of olives causes knots or tubercles on the branches and trunk and seriously interferes with the growth of the tree. Some experiments were also carried on in the application of fungicides to walnut trees and in a study of a disease of the walnut known as melaxuma.

In the nutrition laboratory studies were made on nut proteids, and a bulletin was prepared on the value of nuts in a mixed diet. Analytical work was also done on avocados for incorporation in a general bulletin on that subject published by the station. A considerable quantity of miscellaneous analytical work was done on feeds in cooperation with the agronomy department at Davis.

In the department of agricultural chemistry a study was begun on 14 types of soil to determine the availability of plant food and its relation to productivity. This is planned to be a study of the soil solution from a chemical standpoint. An investigation was made of Pacific Coast kelps. The results of this study showed that the giant kelps contain potash, iodin, and nitrogen in amounts which may justify commercial recovery. A higher percentage of available plant food was found in *Macrocystis pyrifera* than in *Nereocystis luetkeana*. Apparently these plants may best be practically prepared for fertilizer purposes by drying and grinding.

The department of genetics conducted a quantitative study of the size of the flowers in various species and hybrids of Nicotiana. Particular attention was given to a study of oak-walnut hybrids. Apparent crosses have been obtained between oaks and walnuts, but a study of the first-generation hybrids indicates that they are not strictly hybrids, but perhaps the result of parthenogenesis. Crosses between the original hybrids and the wild California black walnut have been made, and two crops of nuts obtained from which only one seedling in eight showed indications of mutation. Breeding work, particularly hybridization, was also conducted with strawberries, corn, tomatoes, peas, beans, and other plants.

The agronomy department carried on work at Davis, El Centro, Fresno, and elsewhere, its investigations being confined largely to 14 projects. This work included variety tests of crops suitable for dry farming, rotation experiments, cultural and fertilizer requirements of various field crops, a study of rye grasses, rotation experiments with and without manures with reference to the full conservation of soil moisture, experiments with Sudan grass, and a study of close planting of Egyptian cotton. It appeared that the Egyptian cotton plant is less likely to have long, straggling, vegetative branches when the plantings are made at close distances.

Most of the work of the animal-husbandry department is carried on at Davis. During the year this work included feeding experiments of a routine nature to determine the relative value of various feeding stuffs, including mistletoe, a study of the value of barley with or without alfalfa for dairy cows, tests with silage of various kinds under California conditions, particularly alfalfa silage, a study of oil meal as food for cows fed on skim milk, observations on soiling versus pasturing for hogs receiving grain, and studies on the feeding value of almond hulls, the economic importance of milch goats, the keeping quality of butter, and the protein requirement of laying hens.

The horticultural department continued its extensive series of experiments in methods of vine pruning, a report on the results of these investigations being published as a bulletin of the station.

Studies were also made of olive by-products with reference to the possible utilization of this material, and also on fruit by-products in general, particularly jellies made from oranges and lemons. In a study of the process of raisin making it was found that the number of pounds of grapes required to make a pound of raisins decreases with the advanced ripening of the grapes. The department of horticulture also continued its experiments and observations on avocados and loquats with reference to the cultural requirements of these plants and their economic importance in California.

The following publications were received from this station during the year: Bulletins 245, Commercial Fertilizers; 246, Vine Pruning in California, II; 247, Some Measuring Devices Used in the Delivery of Irrigation Water; 248, The Economic Value of Pacific Coast Kelps; 249, Stock-poisoning Plants of California; 250, The Loquat; 251, The Utilization of the Nitrogen and Organic Matter in Septic and Imhoff Tank Sludges; 252, The Deterioration of Lumber; 253, Irrigation and Soil Conditions in the Sierra Nevada Foothills, California; 254, The Avocado in California; Circulars 87, revised, Alfalfa; 118, The County Farm Bureau; 119, Winery Directions; 120, Potato Growing in the San Joaquin and Sacramento Deltas of California; 121, Some Things the Prospective Settler Should Know; 132, The Management of Strawberry Soils in the Pajaro Valley and Its Problems; 123, Fundamental Principles of Cooperation in Agriculture; 124, Alfalfa Silage for Fattening Steers; 125, Aphids on Grain and Cantaloups; 126, Spraying for the Grape Leaf Hopper; 127, House Fumigation; 128, Insecticide Formulas; 129, The Control of Citrus Insects; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	123,869.21
Sales	40,291.06
Fees	5,539.13
Miscellaneous	22,555.97
Total	222,255.37

The complete organization of the work of the station on the project basis has given definiteness to all the lines of work and has helped to increase both the scientific and practical value of the investigations in all departments. The activities of the experiment station are widely distributed throughout the State by means of the branch stations at which investigations particularly applicable to local conditions are carried on.

COLORADO.

Agricultural Experiment Station, *Fort Collins.*

C. P. Gillette, M. S., *Director.*

There was an unusually long delay in receiving the State appropriation for the station, a considerable part of it coming only a few weeks before the close of the State fiscal year. Assurances had been received as to the certainty of the last payment, however, and plans had fortunately been matured for its expenditure. The work of the station was, therefore, not seriously jeopardized. At its last session the State legislature provided a mill tax, which will furnish a fund of about $28,000 a year for station work. During the year two silos, some feeding corrals for cattle, and a greenhouse for horticultural work were constructed. An arrangement was entered into with the Bureau of Plant Industry of the Department of Agriculture to carry on cooperatively some experiments with potatoes in the Greeley district. The experiment station will contribute about $5,000 a year toward this work.

Adams-fund projects.—In continuing investigations on plant lice considerable progress was made. Studies were conducted on the life history and food plants of various aphids, particularly those on the peach and apple. Special attention was given to the woolly aphis of the elm and apple, and some work was done on the grain aphis. The results are considered as indicating that the species of plant lice have been somewhat confused, and further critical attention will be given to their life history and food plants.

Studies of the drainage requirements of crops and drainage factors were continued along the lines followed the previous year. This is the fourth year of the investigation, and a large mass of data has been collected. These data will probably be compiled and digested for publication during the coming year. In the projects on weir construction and on conditions affecting operation and accuracy of current meters and the flow of water, a large amount of laboratory work was done, more than 1,400 tests being made during the year. A critical study of the miner's inch showed that this system of measuring water is unreliable. It was found that the number of miner's inches to the second-foot may vary from 33.7 to 42.9. It is recommended that the miner's inch be abandoned as a unit of measuring water, or at least, that it be legally defined as a certain fractional part of a second-foot. The station devised an automatic recording apparatus for tangent water-meter rating stations, which serves also equally well for rotary rating stations. The present meter-rating station is exceptionally well equipped.

In the study of the factors which cause the softening of wheat much attention was given to the condition known as yellow berry in wheat

It was learned that the appearance of yellow or white-mealy or half-mealy spotted kernels in wheat is not due to overripeness nor to exposure after harvesting nor to fungi, but may be lessened or entirely prevented by the application of a sufficient quantity of available nitrogen. The yellow-berry condition was increased or intensified by the use of potash. Phosphorus had no appreciable effect upon its prevalence. It was concluded that yellow berry is due to the presence of potash in the soil in excess of the amount necessary to balance properly the amount of available nitrogen. It was found that yellow berry could be largely controlled by the use of sodium nitrate, thorough cultivation, rotation with legumes, and summer fallowing.

In the further study of the effects of certain plant-food elements upon the chemical composition of wheat it was found that phosphorus exercises but little influence upon the quantity of nitrogen in the stems and leaves of the wheat plant, that the application of nitrogen increases the nitrogen content of the plant materially, and that the use of potash decreases the nitrogen content. It was also found that the application of phosphorus and potash lowers the amount of phosphorus in the plant.

Further studies were made on the raspberry yellows or spur blight. The pathological symptoms of this disease were carefully determined and described. Infection commonly takes place through the leaf and affects the stem or nodes, causing a brown discoloration and cracking of the bark. The disease was shown to be due to a new species of fungus which was described under the name *Sphærella rubina.* Experiments indicated that the disease can be readily controlled by spraying the young canes with Bordeaux mixture containing 3 pounds of copper sulphate and 2 pounds of lime in 50 gallons of water with the addition of 2 pounds of rosin fish-oil soap.

In continuing the project on the bacterial study of alkali soils in relation to nitrogen fixation a systematic examination was made of the Azotobacter flora of a number of niter soils for the purpose of determining whether more than one species of Azotobacter was concerned. A number of strains of *Azotobacter chroococcum* was isolated which differ in the amount of pigment formation, but thus far no new species have been found. Some preliminary work was begun to determine the possible relation of manganese to the fixation of nitrogen by Azotobacter.

Work on the new project on the bacterial disease of field and garden peas was taken up in the field and laboratory. A test was made with 70 varieties of peas to determine the relative resistance to infection.

Work with Hatch and other funds.—The horticultural department cooperated with the chemical department on the niter problem carrying on investigations in orchard management. General orchard

survey and demonstration work was carried on in the western part of the State with the support of State funds appropriated for that purpose. Cultural experiments were also conducted with a considerable variety of garden crops and with hotbeds and cold frames.

The botanical department continued the study of soil algæ. An attempt is being made to isolate them in pure culture. Thus far it has proved impossible to separate the blue-green forms which are so common in Colorado soils. Studies were also begun with methods of weed control with several species of weed pests, particularly dandelions. Observations were made on the Colorado mushrooms and a bulletin was published by the station on that subject. The botanical department is making a study of the decay of wood and of methods of wood preservation.

The entomological and zoological work of the station, in addition to its Adams fund work on plant lice, included a study of the eggs of various species of injurious insects, observations on the life habits of lady beetles, and a general entomological survey, supported by State funds. Some observations were also made on the subject of gopher eradication. A satisfactory formula for gopher poisoning has been devised, and this material is being distributed throughout the State.

In the animal-husbandry department a feeding experiment was carried on with steers for a period of 11 weeks for the purpose of comparing a ration of barley and corn with one of beet-pulp silage and molasses. The experiment was inconclusive and will be repeated.

The study of cereal hybrids was actively continued by the agronomy department, which also made correlation studies with barley, wheat, and oats. Some of the data thus obtained have been tabulated for future publication. Observations were also made on the effect of irrigation upon the correlations of yield and botanical characters. The effect of row culture and irrigation on seed production in alfalfa is being investigated. This work is carried on cooperatively with the Bureau of Plant Industry of the Department of Agriculture. Investigations in the problems of farm management and dry farming have been started. A rather elaborate series of experiments with potatoes was instituted at Greeley. This work includes rotations, varieties, diseases, disease resistance, and various other problems that have to do with the potato.

The veterinary department devoted some time to the investigation of poisonous plants as affecting lambs and to a general animal-disease survey supported by the live-stock inspection fund. Further observations on the brisket disease of cattle at high altitudes confirmed previous observations that this disease is largely due to heart weakness in animals maintained at high elevations and that recovery in such cases can be brought about only by transferring the animals to lower altitudes. An attempt is also being made to overcome the

difficulty by breeding a hardier race of cattle through the use of bulls raised at altitudes of 8,000 feet or more.

The following publications were received from this station during the year: Bulletins 189, Cost of Beef Production Under Semirange Conditions; 195, Small Fruits for Colorado; 196, Some Soil Changes Produced by Microorganisms; 197, Hog-cholera Control—Necrotic Stomatitis; 198, The Onion in Colorado; 199, Vegetable Growing in Colorado—Hotbeds and Cold Frames—Common Insects of the Garden; 200, Silos and Silage in Colorado—Building Instructions for Concrete Silos—Report on Construction of Pit Silos at the Plains Substation; 201, Some Colorado Mushrooms; 202, Testing and Handling of Milk and Cream; 203, Farm Costs on the Colorado Agricultural College Farm; 204, Brisket Disease (Dropsy of High Altitudes); 205, Yellow Berry in Wheat—Its Cause and Prevention; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	15,658.95
Miscellaneous, including balance from previous year	16,304.85
Total	61,963.80

The general outlook for the station appears to be more encouraging than ever before. Apparently the financial difficulties of the station have been satisfactorily settled by the passage of a mill-tax law. The new lines of investigation taken up by the station during the year have greatly strengthened its general program of work and will serve to make it a greater factor than ever in the agricultural advancement of the State.

CONNECTICUT.

The Connecticut Agricultural Experiment Station, *New Haven.*

E. H. Jenkins, Ph. D., *Director.*

The changes taking place in the staff of the station during the past fiscal year were confined to the resignation of H. K. Hayes, in charge of plant-breeding work, who left in December, 1914, to accept a position at the Minnesota college and station, and the appointment of his successor, D. F. Jones, who entered upon his work in February, 1915. By the purchase with funds from the Lockwood trust of 15.4 acres adjacent to the experiment field, the area for station uses was increased to about 35 acres. No increased appropriations for station work were made by the State.

Adams fund projects.—The research work on proteins was continued in cooperation with Yale University and the Carnegie Insti-

tution, of Washington. Further quantitative studies of the nutritive deficiencies of zein, the principal protein of corn, and of the composition and economic value of different proteins were conducted, together with experiments to determine more exactly the relative nutritive value for maintenance and growth of individual members of this group of substances. A number of feeds high in protein, such as brewers' grains, oil cakes, and corn embryo were studied for the purpose of isolating proteids, and the effects of beef fat, lard, and other natural fats on the promotion of growth were investigated. It was found that butter fat is more efficient in this respect than beef fat, and that lard does not supply the growth-producing element. Results of a study of protein minima for maintenance indicated that maintenance can be secured with a lact-albumin content of less than 5 per cent in the diet, about the lowest among the proteins studied, and that this difference is not due to defective utilization in the alimentary tract.

In studying products of hydrolysis of gliadin it was shown that the method in use for determining the amount of the various amino acids is not of standard efficiency. In the isolation of hitherto unrecognized constituents the vegetable protein group formerly known as proteoses was shown to differ widely in anaphylactic reaction from the artificial proteoses, and must be assigned to a not hitherto recognized group of proteins. During the year nine papers were published in scientific journals on the results secured in the pursuit of this project.

Corn-breeding work was continued at the station farm to study the inheritance of characters, especially the starch content. Inbreeding as a means of increasing the protein content of corn and its influence on the vigor of the plants was also studied, and the relation of starch content to growth investigated. The corn-breeding work involved two phases, a theoretical study of the mode of inheritance of characters, and the application to the best advantage of the results when definitely determined. The starch-inheritance and protein-inheritance studies also related largely to the investigation of xenia in corn. Tests were made of first-generation crosses to determine whether an improvement occurs over the better plant, and if so, whether in yield, time of maturity, vigor, or other characters.

The tobacco-breeding investigations centered mainly on the leaf number as a character. The past year's crop represented the 12th or 13th generation. Types were separated on the basis of high and low leaf numbers, and it has been found that lines of a degree of uniformity such as is required by the trade can readily be segregated. In addition to this work crosses were made between commercial varieties in an effort to improve leaf characters such as position, shape, and size.

Work with Hatch and other funds.—Under Hatch and other funds work was carried on by all the departments of the station. The work

of the botanist included among other activities spraying experiments with Bordeaux, soap Bordeaux, and lime sulphur to establish methods of controlling onion blast, selection experiments with melons, studies on selection and temperature of storage of seed potatoes, and observations on the powdery scab of potatoes. Spraying experiments with potatoes and other crops were carried on at the station farm and at nine other places in the State. Spraying tests were conducted also for the control of brown rot and scab of peaches at the station farm, and on a block of 900 trees at Yalesville observations and experiments were continued on peach yellows and little peach. Attention was given to the use of fertilizers in controlling peach yellows, but no definite connection was established, while the effect on color and yield were evident. The laboratory work of this department consisted chiefly of studies of poisonous plants, including mushrooms, of molds on unsalted butter, and of cultures of fungi. A study of chlorosis with special reference to the mosaic disease of tobacco was completed, and the results were published.

The lines of work pursued by the entomological department were supported from other than the Federal funds. In addition to the inspection of nurseries and apiaries required by law the department in cooperation with the Federal Horticultural Board inspected all imported nursery stock brought into the State, and in this connection detected and destroyed a number of dangerous pests. A serious infestation of the gipsy moth which occurred in the eastern part of the State was vigorously fought with funds especially appropriated by the State for the purpose and with the cooperation of the Federal officials. A bulletin on the gipsy moth, giving the history of the different infestations in the State and suggesting methods of control, was published during the year. A second year's test of methods of protection against the cabbage maggot demonstrated the effectiveness of the tarred-paper disk, the use of carbolic-acid emulsion ranking second. Observations were also made on the white-pine weevil and a species of European sawfly found for the first time on nurseries of the State. The control of mosquitoes was given attention, and the station was named as the executive agency in a law passed during the year providing for the elimination of mosquito-breeding places and areas.

The plant breeder, in addition to the Adams fund investigations, did some work with soy-bean selections and with tomatoes, rye, and alfalfa. A bulletin presenting the results secured with soy beans in 1914, mainly with reference to yield, composition of seed and forage, composition of the plant as determined by station analyses, cultural directions based on station experience, and the uses of the crop as suggested by the results as a whole, was published during the year.

The activities of the chemical department, as in previous years, were largely concerned with control work. This included analyses

of fertilizers, feedings stuffs, human foods, and drugs, and the testing of Babcock glassware, all required by statute. The department cooperated with other departments in making the necessary analyses of vegetable products and made a study of the carbohydrates of the soy bean and published the results. Studies on the determination of phenolphthalein in drug mixtures, the composition of infant foods, and the claims of caffein-free coffees were completed. A complete index of the food reports of the station was prepared and printed.

The following publications were received from this station during the year: Bulletins 183, Spray Calendar; 184, Spray Treatment, etc., for Orchards; 185, Field Tests of Soy Beans, 1914; 186, The Gipsy Moth (*Porthetria dispar*); Bulletin of Information 6, The Uses of the Agricultural Experiment Station; and the Annual Report for 1914, parts 1–5.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$7,500.00
United States appropriation, Adams Act	7,500.00
State appropriation	32,000.00
Individuals	9,153.49
Fees	10,400.00
Farm products	49.50
Miscellaneous	1,771.33
Total	68,374.32

The Connecticut State station continues to occupy a position of much usefulness to the agriculture of the State and to supply contributions of high importance to agricultural science. Every effort is made to make its work of practical importance to the farmers of the State and to bring it effectively before them. There are many indications of the esteem in which it is held.

Storrs Agricultural Experiment Station, *Storrs.*

E. H. Jenkins, Ph. D., *Director.*

The Storrs station erected a new poultry building, a 2-story brick structure, during the year and enlarged the dairy building by an addition and a new story. The last legislature provided for securing a right of way for a branch railroad from Eagleville in an effort to make the college and station more accessible. The State appropriation to the station was not increased, although its needs are constantly growing, and no additions were made to the station staff.

Adams fund projects.—The investigation of bacillary white diarrhea of young chicks was continued, and among other features the agglutination test as a reliable means of diagnosis was further studied. The relation of the percentage of positive reaction in a flock to the control or elimination of the disease, and thus cleaning up the stock, was

worked out within certain limits. Aside from the work on the project, private flocks were tested over the State, the work being supported from other sources. Experiments were conducted to determine the toxicity of *Bacillus pullorum* when introduced into the alimentary canal of rabbits, cats, and other animals by means of infected egg material, and studies were made of the transmission of the organism to ascertain how infection is or may be brought about.

The study of blackhead in turkeys was pursued with special reference to the rôle bacteria may play in the infection, with a view to working out a method and obtaining material for a test as a means of detecting the disease. In this connection organisms were isolated and studied as to their possible relation to the malady.

The investigation of the relation of the bacteria of the egg to the growth of the embryo was continued in cooperation with the chemist and was brought to a close at the end of the year. The work reported consisted mainly of incubation experiments and had a bearing principally upon the effect of moisture. The humidity of the air passing through the incubator was controlled, and an effort was made to determine the maximum and minimum limits of moisture. It was found that the range between the amount required and the point at which moisture becomes injurious was quite wide. While the humidity varied in these tests, the temperature and the carbon dioxid content of the air were kept normal. The effects of dryness and of different degrees of humidity during the beginning and toward the close of incubation were also studied.

The soil-biology work was not very active during the year, but the flora of tobacco-sick soil was worked out, and a few organisms considered inhibitive in character and as positively connected with poor tobacco production were isolated and studied. Three plats were treated with fertilizers in different amounts, and the frozen soil was studied, with the result that marked differences and a pronounced correlation between a high content of organic matter and a high number of organisms were found to exist. On another series of plats the effect of organic and inorganic fertilizers on the bacterial flora was studied to ascertain what relation soil bacteria have to fertility or to rendering certain materials available to the plant. Ground limestone and ground rock phosphate, alone or in combination with various kinds of organic materials such as manure, cottonseed meal, alfalfa, leaves, and various green-manure crops, were applied to a series of plats on which several different crops were grown the past year in an attempt to measure the fertility of the different plats and the extent of bacterial action in making available the raw rock phosphate and the natural soil constituents. Bacterial examination of these plats showed differences in the flora where different forms of organic matter were applied.

Work with Hatch and other funds.—A number of different lines of work were carried under Hatch and other funds. The principal work of the poultry department included a determination of growth curves for growing chicks, studies of the inheritance of fecundity and other characters, experiments with simple rations for the ultimate purpose of determining the exact proteids essential to chick growth, collection of statistical data in connection with the laying contest, and tests of milk as a substitute for meal for laying hens. Sweet and sour milk were fed and their effect on the health and mortality of the chicks was noted. In other feeding experiments the ration used in the egg-laying contest was compared with simpler rations having a smaller number of constituents. It was found that cracked corn with a mash of corn meal and bran with sour milk gives fairly satisfactory growth and that milk feeding makes meat scrap unnecessary for layers. Three growth curves were secured on two varieties of fowls. In the inheritance work the F_1 generation was reared and was maintained for further study the following year.

The agronomist made progress in the improvement of the experimental tract, which embraces about 12 acres, and conducted variety tests with potatoes, wheat, oats, rye, barley, root crops, soy beans, and corn, and fertilizer experiments with potatoes. The possibility of growing seed potatoes in Connecticut was given attention, and such tubers were compared with Maine-grown seed. Tests of the cooking quality of different varieties of potatoes were also made. The object of the work with soy beans was to sort out and describe the varieties, to establish standard sorts, and to eliminate synonyms. A special feature was made of the study of three different rotations to determine a rational practice for the dairy farm regarding crop production and the effect on the fertility of the soil. Studies in soil bacteriology were conducted on these plats in cooperation with the bacteriologist.

The corn survey of the State was conducted for the second season in cooperation with the station at New Haven, with a view to the application of results obtained in the plant-breeding work at that place. Among the results obtained by the agronomy department during the first two years of its existence may be mentioned the indication that winter wheat may be grown with satisfactory results on a limited amount of fertilizer, and that results taken together with those secured at New Haven seemed to show that wheat is hardy almost anywhere in the State. Mangolds proved a satisfactory crop, even in a dry season.

The dairy department continued work on the cost of milk production, and conducted an experiment in calf feeding on the relative efficiency of a dilute milk ration, a silage ration, and the ordinary mixed-feed ration. Studies of seasonal influences on the butter and

the lactometer readings of milk, and a comparison of actual and estimated yields of individual cows were begun. Observations were also made on the relation between the actual amount of silage in a silo and the estimated amount. Attention was further given to the control of contagious abortion.

The zoologist made a study of poultry parasites, their life histories, and control measures, and also of the poisoning of chickens by eating rose chafers. Accurate data were obtained on the life cycle of several of the commen hen and chicken lice, and it was shown that the poultry mite hibernates in the adult stage. Other results obtained indicated that the death of chickens which eat rose chafers is due to toxic elements and not to mechanical injury of the digestive system.

The publications received from this station during the year were as follows: Bulletins 78, Cheeses of the Neufchatel Group; 79, Studies Relating to the Roquefort and Camembert Type of Cheese—General Weather Review for the Locality of Storrs, Connecticut, 1912 and 1913; 80, Chickens—Milk Feeding and its Influence on Growth and Mortality—Comparative Study of the Value of Sweet and Sour Milk; and the Biennial Report, 1912–13.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$7,500.00
United States appropriation, Adams Act	7,500.00
State appropriation	4,500.00
Farm products	3,968.64
Miscellaneous	1,196.01
Total	24,664.65

The Connecticut Storrs station conducts a number of lines of important work, which are so planned as to avoid duplication of the work at the New Haven station. In this way the two stations are made to supplement each other to advantage, rendering good returns for the funds invested.

DELAWARE.

The Delaware College Agricultural Experiment Station, *Newark.*

H. Hayward, M. S. Agr., *Director.*

There was material improvement during the past fiscal year in the outlook for the Delaware station in the direction of increased funds and facilities. The legislature appropriated $5,000 for the agricultural department to supplement the Federal funds of the station for the year ending June 30, 1916. The college received a gift of $500,000, of which $300,000 will be used for buildings, among them one for agriculture, in which the station will share.

Adams fund projects.—Progress was made in the study of the root-rot diseases of the sweet potato, and station Bulletin 109 on this

subject was published during the year. Different rots were studied as to certain phases in their life history, the kind and extent of injury resulting from their attacks, and the relative efficiency of measures of prevention and control. It was reported, among other facts, that black rot is carried with the seed to the seed bed, and from there to the land, and that soft rot and ring rot are both serious storage troubles, induced mostly by poor ventilation. The trichoderma rot was found associated with ring rot as a minor storage trouble, and charcoal rot, often mistaken for black rot, was shown to follow soft rot frequently.

Corrosive sublimate gave better results for seed treatment than formaldehyde in controlling diseases of the sweet potato carried with the seed, and seed infected with black rot was not benefited by sulphur applied in the seed bed. Work was also in progress on the soil-rot disease, which was found to injure the young plants to a greater extent than it does the tubers, but no very definite results were reached. Studies were made of different types of sweet-potato storage, and it is believed that artificial ventilation and drying offer promising means in solving the difficulties connected with the storage problem. Other studies during the year included the determination of the cause of a skin disease known as scurf.

A study of diseases in cucurbits recently undertaken showed that watermelons grown for two years in succession on the same ground are likely to fail on account of anthracnose, which has previously been considered as unimportant. Two new diseases of the fruit were found, and studies of their behavior were begun. It was observed that while the anthracnose of watermelons attacks cantaloups also it proves less injurious to the latter.

Work with reference to peach yellows, little peach, and rosette was confined mainly to gathering material for inoculation and to making a planting of several different varieties preparatory to entering upon an investigation of the subject.

The soil-bacteriological project included a study of the flora of some 50 different soils to a depth of 8 inches and of the subsoil from 8 to 16 inches. Culture methods were worked out for making quantitative studies of the different groups of organisms in question, and a medium was perfected by means of which an accurate quantitative count of the Azoto group may be obtained. Azotobacter was found to vary greatly in different soils. Heavy applications of manure undergoing anaerobic fermentation were found, when plowed under or incorporated with the soil, to inhibit and reduce quickly the more beneficial organisms such as *B. radicicola*, the Azoto group, and the nitrifiers, while the use of lime gave better results in this respect.

The investigation of a bacterial disease of legumes was completed the preceding year, but the results were published during the past

year as Bulletin 106 of the station. Among other results it was definitely shown that the streak disease of the sweet pea is caused by *Bacillus lathyri.*

A study of the response of different types of wheat to various kinds and quantities of plant food was continued, and much of the analytical work was brought up to date. The relation of tillering to plant-food supplies of the soil, and of the phosphoric acid to the number of barren spikelets was studied, and the proportion of sterile or barren spikelets in a number of bearded and smooth varieties was determined. Over 100 varieties have been tested, and among these the bearded ones gave the better results.

The agronomy department continued its work on the effect of variation in physical factors and chemical composition of the corn kernel on the vigor of the plant. Summaries of data and studies were made to establish possible correlations and to determine the relative importance of the different factors. The chemist cooperated in this project by making separate analyses of the cobs and grain.

Some field studies were conducted on the effect of various forms of lime on the decomposition of the organic matters in the soil, but otherwise the project was held in abeyance, pending the provision of certain means to continue the work under controlled conditions.

Good progress was reported in the study of the function of the principal plant-food elements in the growth of the peach and the apple. The first crop of peaches from the trees grown under control in pits was secured the past year. The results from both pit and orchard grown trees indicated that nitrogen is a potent factor in determining the vitality of the trees as well as the production of fruit. A few of the apple trees to be studied came to bearing during the year, but the quantity of material thus obtained was insufficient to warrant deductions. A preliminary report on the studies with the peach was made before the Society for Horticultural Science.

The investigation of the composition of fruit juice conducted by the chemist included a study on the determination of tartaric and malic acids in the presence of each other and of the changes which take place in these acids and the sugars. In connection with the work on the determination of the acids good results were secured with artificial mixtures, but with fruit juices the presence of coloring matters presented certain difficulties.

In the study of soy-bean hay alcohol extracts were made in an attempt to separate an essential oil or other substances as the possible cause of reported poisonous effects resulting from feeding the hay. The presence of a poisonous substance in the hay was demonstrated, but its nature has not yet been determined.

The inbreeding project conducted with dairy cattle and swine gave some very good results, especially with pigs. As high as 75 per cent of inbreeding has been secured. The work seemed to show that up to 50 per cent inbreeding is not detrimental, while above that injurious effects become apparent. With dairy cattle inbreeding of the daughters to the sire gave but few calves, which were weak and subject to pneumonia, so that only a part of them were raised. Not quite 50 per cent of inbreeding has been obtained with cattle.

Work with Hatch and other funds.—The work under these funds was confined largely to the departments of horticulture and agronomy. The horticulturist's work on an area of 8 acres with cover crops for peaches and apples proved cowpeas to be one of the best cover crops for peaches, giving much the same effect as applications of nitrogen. About 10 acres were used for variety studies with fruits and some fertilizer work with vegetables, particularly tomatoes.

The agronomist continued rotation experiments with fertilizers on 80 one-tenth acre plats, also a set of rotations to study the effect of green manures on potatoes, some work with alfalfa in rotations, and tests with different forms of phosphoric acid for alfalfa. Some of the results secured in the alfalfa experiments were summarized and published during the year as Bulletin 110 of the station. It was reported that inoculation increased the effectiveness of lime and fertilizers 100 per cent. A complete fertilizer, approximately a 3:10:6 mixture at the rate of 600 to 800 pounds per acre is recommended where alfalfa follows wheat or oats, and when following potatoes or other tilled crops a mixture containing 12 per cent of phosphoric acid and 6 per cent of potash applied at the rate of 400 to 600 pounds per acre is considered sufficient. The experiments indicated that alfalfa was most benefited by the application of phosphoric acid while the effect of potash was less marked, yet the two substances combined gave the greatest net profit of the various treatments compared.

The chemist made analyses of samples of soil fertilizers and lime and did considerable work in cooperation with other departments of the station. There was no Hatch fund work in the animal-husbandry or bacteriological departments.

The publications received from this station during the year were as follows: Bulletins 103, Annual Report of the Director for the Fiscal Year Ending June 30, 1913; 104, Lime and Its Uses on Land: I, Forms of Lime, II, The Use of Lime; 105, The Composition of Lime-sulphur Solutions; 106, the Diseases of The Sweet Pea; 107, Annual Report of the Director for the Fiscal Year Ending June 30, 1914; Circulars 7, Farmers' Day Guide, 1912; 8, Farmers' Day Guide, 1913; and 9, Farmers' Day Guide, 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	14,700.00
Balance from United States appropriation, Adams fund	300.00
Farm products	5,638.47
Total	35,638.47

The Delaware station made considerable advance during the past year. It is in a stronger position than ever before and is meeting the needs of the State in many different directions. The appropriation received from the State will materially relieve it in adjusting its funds.

FLORIDA.

Agricultural Experiment Station of Florida, *Gainesville.*

P. H. Rolfs, M. S., *Director.*

Some changes in the organization of the station staff were made during the year. The director became also dean of the college of agriculture, and the animal husbandman was made vice director and will assist in administrative and business matters, while the director will retain the function of directing research work as heretofore. Few changes occurred in the personnel of the staff. C. D. Sherbakoff was appointed associate plant pathologist and will devote his time largely to the diseases of truck crops; H. G. Clayton was appointed laboratory assistant in animal husbandry. The director of the station is a member of the advisory committee which has in charge the organization of the Florida Plant Act of 1915. This act appropriated $195,000 for the eradication of citrus canker and $35,000 annually for nursery inspection and the suppression of plant diseases. An addition was made to the equipment of the dairy barn at a cost of $10,000 (Pl. II, fig. 2).

Adams fund projects.—The study of soils and fertilizers in relation to the growth of plants, particularly citrus fruit, was continued. In the large orchard where fertilizer applications have been made further fertilizer work was suspended temporarily on account of the occurrence of die-back. Determinations were made of the composition of the drainage water and of the leaves and twigs. An attempt is being made to determine the relation of fertilizers to the acidity of the soil. Since the orchard has come into bearing fruit, analyses will be made to learn any correlations which may exist between the chemical composition of the fruit and the treatment which the orchard received.

Interesting results were obtained in the project on plant nutrition with reference to physiological diseases. This work involves investigations in the greenhouse supplemented by field work in orchards in several localities. Particular attention is devoted to the relation

of fertilizers to physiological disturbances in the plant. This work includes a study of the effect of the quantity and combination of fertilizers upon the physiological condition of citrus trees, the effect of organic compounds on the growth of the tree, and the nature and cause of die-back, frenching, yellow spotting, bark burning, and gum formation. The results obtained during the year indicate that die-back is likely to follow the use of organic nitrogen combined with excessive cultivation. Dried blood was found to be superior to other sources of nitrogen in producing growth. Basic slag produced a greater amount of growth than other kinds of phosphates. The addition of lime alone to the soil brought about a greater growth than was produced by an application of sulphate of ammonia, acid phosphate, and sulphate of potash.

The investigation of the parasites of the white fly included studies in introducing parasites and spraying experiments in the destruction of the woolly white fly. The prevalence of a drought appears to be favorable to the great multiplication of the white fly. It was found that the red and brown parasitic fungi could be kept over winter in a dry condition. The most effective method of controlling the white fly appears to be found in spreading the parasitic fungi during the rainy season and spraying with miscible oil in spring and fall. The woolly white fly is said to be rapidly spreading in the State and to be able to cause great damage when present in excessive numbers. The woolly white fly is heavily parasitized by a minute hymenopterous insect.

A beginning was made in the study of the velvet-bean caterpillar. Preliminary experiments with a fungus parasite belonging to Botrytis indicated that this fungus is quite effective. It appears that the velvet-bean caterpillar migrates each year from the southern part of the State, or possibly from Cuba. The use of arsenicals in controlling this pest is somewhat hindered by the sensitiveness of the velvet bean to these insecticides. Studies were continued on the life history and habits of *Euthrips projectus* and *Cryptothrips floridensis*. The latter species appears to be confined to Florida and causes considerable injury in nurseries.

In the investigation of citrus diseases attention was given chiefly to melanose, canker, and gummosis. The specific cause of gummosis has not yet been determined. Various remedies were tried for it without satisfactory results. The citrus canker occupied a large share of attention. Thus far no satisfactory treatment for the disease has been devised. It apparently can be controlled only by eradication of affected trees.

The investigation of vegetable diseases was confined largely to the bacterial diseases of tomatoes, eggplants, and related crops, and of diseases which cause damping-off in the seed bed. An attempt is

being made to determine whether the same organism is concerned in producing this disease in all plants thus far tested, including lettuce, cabbage, eggplants, beans, cauliflower, etc. The fungus disease of pecan known as die-back was found to be due to *Botryosphæria berengeriana*. Work on the pineapple wilts was also continued.

Breeding experiments with velvet beans and their allies yielded interesting results, both from a scientific and a practical standpoint. By crossing and selection several valuable strains have been secured, and in this work a distinct contribution has been made to the knowledge of the inheritance of such characters as fertility, sterility, earliness, lateness, mottling, pubescence of pods, etc. Particular attention was given to a study of the behavior of hybrids between Florida velvet bean and Lyon velvet bean. It was found that in the third generation fertile parents produce progeny with sound pollen grains and that semisterile parents produce progeny, half of which has sound pollen grains and half semiaborted pollen grains.

Work with Hatch and other funds.—The principal lines of work carried on by the department of animal husbandry under the support of Hatch funds were feeding experiments with pigs, dairy cows, and calves. A great variation in the cost of milk production was found in different cows ranging from 7.4 cents to 20.3 cents per gallon of milk. In some calf-feeding experiments the value of velvet-bean meal was tested as a supplementary grain feed. The addition of velvet-bean meal to the ration for calves appeared to cause no economy in gain. Dasheens were fed to hogs for the purpose of determining their nutritive value. In a series of tests it was found that hogs made the cheapest gain when fed a mixed ration of equal weights of corn and dasheens.

A number of experiments with field crops were carried on during the year. This work involved a study of varieties of soy beans and velvet beans, breeding experiments with cotton, corn, and sorghum, tests of cowpeas and soy beans for hay, and fertilizer experiments with Japanese cane. For Japanese cane it was found that potash is most beneficial, while nitrogen appeared to be next in importance, and phosphate of still less importance. Ground limestone acted as a temporary stimulant. The yield per acre decreased each year from the ratoon crops, and it appears best to replant the cane at least every third or fourth year.

In addition to its Adams fund projects in plant pathology the station continued a survey on the diseases of vegetable crops and accumulated a great mass of data on the prevalence, distribution, and means of controlling citrus canker. For several years observations have been made on the progress of the mango industry in Florida, and the results of these observations and experiments were published

in bulletin form. In addition to the Adams fund projects in entomology, the station published the results of its experiments and observations on the common tomato insects.

The following publications were received from this station during the year: Bulletins 123, White Fly Control, 1914; 124, Citrus Canker: II, History of Citrus Canker—Studies of Citrus Canker—Eradication of Citrus Canker; 125, Tomato Insects, Root-knot, and "White Mold"; 126, The Woolly White Fly; 127, Mangoes in Florida; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
Farm products	1,301.92
Balance from previous year	694.48
Total	31,996.40

The Florida station is making valuable contributions to the subject of plant breeding and other lines of research. It maintains a leadership in the State in various fields of agricultural industry, such as the production of citrus fruit, pineapples, legumes, and forage crops, and in dairying and practical entomology.

GEORGIA.

Georgia Agricultural Experiment Station, *Experiment.*

R. J. H. DeLoach, A. M., *Director.*

All the work of the station has been placed on a project basis, and questions concerned with the progress and conduct of these projects are discussed at weekly meetings of the staff. The administration of the station has been strengthened and its activities given definite experimental form. There were no changes in the station staff during the year. A State appropriation of $2,500 was received for use in repairing buildings and adding to the equipment of the laboratories and library. Arrangements were made whereby the station will have five or more series of cooperative plats in different parts of the State where variety tests of field crops and investigations in the use of fertilizers may be carried on.

Adams fund projects.—The study of balance of acid-forming and base-forming elements as a factor in the toxicity of cottonseed meal was practically completed and the material is being prepared for publication. In this work it was found that 25 grams of cottonseed meal per kilogram of live weight in the daily ration would kill 6-weeks-old pigs in 40 days. The acid-forming constituents appeared to play but little or no part in the toxicity. During these experiments it appeared that other kinds of feed with a protein content as high as

cottonseed meal were almost if not quite as likely to kill pigs as was cottonseed meal.

The project on the relation of cottonseed oil in the ration to the hardness and other changes in butter fat made some progress. It was found that 1 gram of oil per kilogram of live weight per day is about the maximum amount which can be fed to cows without injuring the quality of the butter.

Breeding experiments with *Vitis rotundifolia* to determine the application of Mendel's law to the hybridization of the black and white varieties of the Muscadine grape were continued in the same manner as during the previous year. White staminate types were crossed with black pistillate ones. The results indicated white to be recessive and black as dominant. About 1,000 hybrid seedlings have been produced during the course of this work. A microscopic study is now being made of the pollen at various stages of development.

Interesting results were obtained from a study of the influence of combinations of feeds on the digestibility of the different components. It was found that starch when fed in excessive amounts exerts a depressing effect upon the digestibility of nitrogen and crude fiber. This depression, however, was largely overcome by the addition of cottonseed meal to the ration. An increase in the amount of crude fiber in the ration did not unfavorably affect the digestibility of nitrogen-free extract. When steers were changed from one ration to another they appeared not to be capable of so complete digestion at first, particularly if the change was from a rich to a poor ration.

The investigation of the effect of stable manure on the bacterial flora of the soil showed that manure hastens the decay of organic material in the soil. New methods are being devised for measuring accurately the rate of decay. The study of the comparative value of nutritive salt solutions and soil solution as media for *Pseudomonas radicicola* indicated that this organism grows best in the soil solution. The organism was found to survive for five years in a soil which apparently contained no moisture in excess of hygroscopic moisture. A number of commercial cultures of nitrogen-gathering bacteria were studied in connection with this work and proved to be worthless.

In the investigation of plum wilt it was found that the fungus enters through wounds and passes toward the center of the tree and also upward and downward. The fungus makes its way through the water ducts, plugging them with a gummy substance and causing wilting of the leaves. The tree dies within one year from the time of infection. The fungus has been isolated in pure cultures, and its pathogenic nature proved by inoculation. Its identity, however, has not been determined. Good progress was made in the study of the function of microspores in their relation to ascomycetes, and also

in the investigation of the twig canker of the Japanese plum. The causative organism of this disease has been isolated.

Work with Hatch and other funds.—The agronomy department carried on variety experiments with cowpeas, soy beans, and velvet beans, with particular reference to their adaptability in crop rotations and general farm practice. It appeared from this work that the general culture of the velvet bean can be considerably extended in the northern part of the State. Much work was also done on winter cover crops and varieties of winter grains. This appears to be an important field of investigation from a practical standpoint in Georgia. Variety tests were also carried on with corn and cotton. Considerable attention was given to a study of forage crops for hay and pasture purposes, the selective breeding of farm crops, and the study of fertilizers for cotton and corn.

The horticultural work of the station included an investigation of methods of storing and keeping sweet potatoes. Large losses have been suffered in stored sweet potatoes, and it is hoped that the chief factors in these losses and the means of preventing them may be discovered. An investigation was also made of cultural and propagation methods for pecans, experiments with seedling Elberta peaches in an attempt to secure a late-ripening variety, cooperative experiments with fertilizers on apples, hybridization of the cabbage and collard, and the effect of crown gall on the growth of apples. A general study was made of the cultural requirements, diseases, and insect pests of the tomato. The general botanical work of the station included a study of pear blight for the purpose of securing, if possible, a resistant variety and the continuation of a plant-disease survey of the State.

In addition to its Adams fund projects the department of animal husbandry made numerous observations and carried on some experiments in the construction of silos, preparation of silage, and the dehorning of cattle.

The following publications were received from this station during the year: Bulletins 109, Digestion and Metabolism of a Steer When Placed on a Continuous Ration of Corn Silage; 110, Silos and Silage; 111, Dehorning Cattle; 112, Tomatoes; 113, Variety Work with Corn and Cotton; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	3,262.09
Farm products, including balance from previous year	2,975.65
Total	36,237.74

The station has put forth its best efforts in encouraging scientific investigation and in giving impetus among the staff officers to a

broad view of agricultural research. The problems selected for research work are those which are considered as being of most importance in the development of the agriculture of Georgia. The new State appropriation will aid the station materially in its work of equipment.

GUAM.

Guam Agricultural Experiment Station.

A. C. Hartenbower, B. S., *Agronomist in charge.*

During the past year the equipment of the Guam station was extended in various directions with a view to conducting more detailed experimental work, especially along lines of immediate importance to the agriculture of the island. Among other improvements a better and more reliable water supply was provided, several lots were fenced for pasture, and the fences of the station farm were generally rebuilt. Attention was also given to the surroundings of the station buildings, and considerable improvement was effected by grading, lawn making, and ornamental planting.

Experiments already in progress were continued during the year, and some new work, including experiments with field, garden, and orchard crops, feeding test with hogs, and studies of animal diseases, was taken up at its close. Improvement work was also begun on the Cotot stock farm acquired the preceding year, and work with live stock was inaugurated.

The results of an experiment with peppers showed that shading had little or no effect in reducing the pungency of the fruit during the dry season, but that it is a valuable means for increasing the yield and the quality of the crop. It was demonstrated during the wet season that on heavy lowland soil with its naturally poor drainage but few vegetables can be produced in August, September, October, and part of November. Land was cleared on a sidehill to compare vegetable culture under lowland and hillside conditions. Plant-introduction work received considerable attention, a large number of varieties of vegetables, tropical fruits, and field and forage crops being introduced, and important seed and plant distributions were made. About one-half acre was set aside as a nursery for growing cuttings and plants for distribution, and the station's pineapple and banana fields were extended for the same purpose. With the cooperation of the police department of the naval government of the island the proper planting and care of the material sent out was generally assured.

Breeding experiments with horses, cattle, hogs, goats, and chickens were continued, with the uniform results that the station's pure-bred sires brought about a marked improvement in the native stock even

in the first generation, although from the standpoint of hardiness a certain percentage of native blood seems desirable. In a further effort to improve the live stock of the island one of the station's bulls was kept for certain periods at different points to give native farmers the opportunity of breeding their cows to improved stock.

Corn-culture experiments conducted at the station indicated that the effects of undesirable moisture distribution may be largely overcome by a deeper and better seed-bed preparation, a greater distance between plants in the row, and by more frequent cultivation. An experiment for the improvement of the native corn was begun to secure earlier maturity, the production of but one ear per stalk, and uniformity of crop. From the second crop of the past year good ears were selected from plants meeting the requirements and tested by the ear-to-row method.

Varieties of cotton were tested under wet and dry season conditions, and an experiment for the production of a ratoon crop of Egyptian and other types was conducted. Egyptian Yuma cotton yielded at the rate of 1,641 pounds of seed cotton per acre, and cotton of the Sea Island type produced a staple high in quality and market value. Forage-crop studies were carried on with Para grass, Paspalum, feterita, Kafir, cowpeas, and soy beans. For hog pasture cowpeas gave better results than soy beans.

Live-stock disease investigations centered mainly upon tick-fever and liver-fluke investigations, stomach worms in cattle, lard worm and lungworm in hogs, and white diarrhea, sorehead, cholera, roup, and internal and external parasites of poultry. A study of the ticks infesting cattle, horses, carabao, goats, and deer did not establish any difference between them. Observations were made on the effects of tick infestation on the body temperature and the growth of native cattle, and a temperature chart of one of the imported cows infested with ticks was drawn, showing frequent fluctuations and a range from 99° to 108° F. for the year.

The infestation of cattle, hogs, and goats with liver flukes was studied, and for the prevention of losses draining of swamps and their treatment with salt and lime to exterminate the fresh-water snails, keeping swampy pastures free from animals, introducing frogs and toads to aid in eradicating the snails, and burning of pastures to destroy the encysted embryos were suggested. Considerable success was achieved in combating white diarrhea in chicks by cleaning the houses and yards daily and burning all refuse, keeping the chicks in the incubator without food for at least 52 hours after hatching, and giving twice daily drinking water made up of a bichlorid of mercury solution of 1 to 10,000 and containing per gallon 3 grains of citric acid and a 30° sulpho-carbonate tablet. Observations on diphtheritic roup showed as many as 50 per cent of a brood of young

chicks affected with the disease and the mortality among untreated chicks as high as 90 per cent.

Attention was also given to apiculture. Seasonal and other conditions proved very satisfactory to the work, which is conducted mainly for the purpose of extending beekeeping on the island and for the introduction of better apicultural methods.

The annual report for 1914 was received from this station during the year.

The income of the station during the past fiscal year was as follows:

United States appropriation	$15,000.00
Sales, including balance from previous year	548.21
Total	15,548.21

The Guam station makes continued progress in improving the agricultural conditions of the island, stimulating the interest of the natives in better methods of crop production and stock raising, and in broadening its usefulness generally.

HAWAII.

Hawaii Agricultural Experiment Station, *Honolulu.*

J. M. Westgate, M. S., *Agronomist in charge.*

The main efforts of the station as in previous years were devoted to the establishment of a rational system of diversified agriculture in the Territory. To this end data are being collected and experiments conducted with reference to the agricultural possibilities of various crops on the different soils of the several islands composing the Territory. During the year minor repairs and additions were made in connection with the station buildings, but no new buildings were erected. The Marine Hospital tract of land adjoining the station and containing about 3 acres of arable land was turned over to the station for experimental uses. Preliminary arrangements were also made for securing 10 acres of land on the large Army reservation near Schofield Barracks for use in forage production for Army horses.

A number of changes in the station staff occurred during the year. E. V. Wilcox, formerly in charge of the station, was transferred to the Department of Agriculture and was succeeded by J. M. Westgate. W. P. Kelley, chemist, D. T. Fullaway, entomologist, and F. A. Clowes, superintendent of the Hawaii substations, resigned. W. T. McGeorge succeeded Dr. Kelley as chemist, and in turn was transferred to the Department of Agriculture, being succeeded by M. O. Johnson. J. B. Thompson was appointed as superintendent of Hawaii substations, and F. G. Krauss, formerly agronomist of the station, was appointed as superintendent of extension work.

The Territorial marketing division under the supervision of the station continued its operations on a larger scale than heretofore and with highly satisfactory results. The produce handled by this division of the station included practically all of the commercial agricultural products of the Territory except sugar. Chief among the products which were shipped to the mainland by the marketing division were pineapples, bananas, beans, and copra. A weekly market-quotation sheet, giving the current wholesale quotations on island products, was issued for the purpose of keeping the growers informed regarding the conditions of the market.

The Territorial legislature appropriated for the use of the marketing division during the coming year the sum of $14,400 for a new building and equipment and $1,000 a month for general expenses and maintenance. An additional appropriation of $7,500 was made to be used as a revolving fund for buying seed and crates to be resold to farmers and for making advances on consignments.

Since the Smith-Lever Act applies only to mainland States and not to Hawaii, Porto Rico, or Alaska, provision is made in the regular appropriation bill to the Department of Agriculture for the establishment of an extension division of the station. The work of the extension division was naturally made to center around the substations, but also included assistance at agricultural fairs, fostering of boys' and girls' agricultural clubs, field demonstrations of improved means of crop production, and advice and assistance in the organization of farmers' associations devoted to marketing and community improvement. As usual in extension work, a large amount of correspondence regarding practical agricultural matters has developed in connection with this phase of station operations.

The failure of the Territorial legislature to appropriate funds for substation work made it necessary to abandon all the substations except the one at Glenwood. By the use of extension funds, however, it has been possible to employ several collaborators who devote portions of their own farms to demonstration work and use the results thus obtained as a basis in part for extension work among farmers. At the Glenwood substation experiments were continued in testing various forage crops for this excessively rainy district and in improving methods of handling dairy cows and poultry.

The horticultural work of the station was largely directed to a study of litchi, mango, avocado, papaya, and miscellaneous fruits and ornamentals. The litchi ordinarily comes into bearing only after it reaches several years of age. This long wait is one of the reasons for the limited supply of this fruit. An attempt is being made to develop better methods of propagation and to place this fruit among the list of profitable commercial crops. The study of

the mango was continued with particular reference to the anatomy of flowers and the technique of pollination. Many experiments were made in the method of propagation known as bark grafting, and these experiments were attended with considerable success. It appears that some of the new varieties of mango are quite resistant to attacks of Mediterranean fruit fly.

Observations were also made on the keeping quality of avocados. It was found that fruits would keep at the ordinary air temperature for 16 days without deterioration. Bark grafting as a method of propagation was also tried with the avocado, but without much success. The breeding studies which have been in progress for several years on the papaya were continued. Cross-pollination experiments were carried out between *Aleurites moluccana* and *A. fordii*. The former is a candlenut tree and the latter a China wood-oil tree. As a result of these experiments 120 apparently hybrid nuts were obtained.

The entomologist of the station was absent on leave during the greater part of the year, and the entomological work was therefore for the most part in abeyance.

The chemical investigations of the station were largely confined to a study of soils, application of fertilizers, and the use of arsenite of soda as a spray. In comparing the relative value of different forms of phosphate fertilizers an elaborate series of pot experiments was carried on for two and one-half years with Japanese millet, cowpeas, and buckwheat. The results of this investigation indicated clearly that bone meal or difficultly soluble phosphates are of little value as fertilizers on Hawaii soils as compared with the soluble phosphates, except in wet districts. It was also shown that iron and aluminum phosphates are satisfactory forms of phosphate for plant growth. The organic phosphorus in rice was found to be present in the form of phytin.

Pot experiments were also carried on with 32 species of legumes, and most of these species were grown in the field in a set of parallel experiments. It was found that the nitrates in pots where legumes had been grown were in smaller quantity than in the check pots, but after removing the plants and allowing the pot to stand in the open the amount of nitrates soon equalled that in the check.

A further study of arsenite of soda as a spray for killing weeds showed that this spray when it comes in contact with the soil is quickly fixed by the upper 3 or 4 inches of the soil. The results of six years' study of the physical and chemical properties of Hawaiian soils were published in a bulletin in which particular attention was given to the practical bearing of these scientific investigations.

The agronomic work of the station included a study of soil aeration in connection with the growth of rice and taro, fungicide treatment

for preventing potato blight, comparative tests of the value of different legumes for green manuring, and cultural experiments with sorghums, forage grasses, Japanese millet, buckwheat, and various other crops. Some increase was noted in the yield of rice and taro as a result of aerating the soil during the interval between the two crops. In a test of various legumes for green manuring, jack beans and velvet beans appeared to be the most promising. Common alfalfa outyielded both the Peruvian and Turkestan varieties.

Of the various forage grasses tested during the year, Sudan grass appeared to be the most promising for use in Hawaii. Satisfactory results were also obtained from Giant Bermuda grass and several other grasses. Japanese millet promises to be of much value as a forage crop. Yields of 30 bushels of seed per acre and 12 tons of green forage were obtained.

The following publications were received from this station during the year: Bulletins 35, Absorption of Fertilizer Salts by Hawaiian Soils; 36, Grasses and Forage Plants of Hawaii; 37, Ammonification and Nitrification in Hawaiian Soils; 38, Effect of Fertilizers on the Physical Properties of Hawaiian Soils; Press Bulletins 46, Poultry Management; 47, Cold Storage for Tropical Fruits; 48, Suppression of Weeds Among Pineapples by Arsenite of Soda Spray; 49, A Cheap and Effective Homemade Plank Drag; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation	$35,000.00
Sales, including balance from previous year	1,181.79
Total	36,181.79

The Hawaii station by means of its scientific investigations and its extension work is gradually laying a satisfactory foundation for the establishment of a rational system of diversified agriculture, which will give due prominence to a considerable variety of crops of immediate use to the inhabitants of the Territory and also suitable for shipment to the mainland.

IDAHO.

Agricultural Experiment Station of the University of Idaho, *Moscow.*

J. S. Jones, M. S. A., *Director.*

At the Idaho station the year was to some extent one of readjustment, due to a number of changes which occurred in the personnel of the staff. Director W. L. Carlyle resigned, and after an interval Prof. J. S. Jones was appointed acting director and finally at the close of the year was made director. Resignations from the staff included C. E. Temple, the botanist; J. F. Nicholson, the bacteriologist; and F. L. Kennard, the agronomist. N. S. Robb was appointed agronomist, and Dr. J. J. Putnam bacteriologist.

Two concrete silos were erected for experimental work at the cattle barn. The legislature appropriated $5,000 for the maintenance of the Aberdeen substation, $4,000 for the Gooding substation, $2,000 for the Caldwell farm, and $4,800 for the substation at Sandpoint, for the biennium.

Adams fund projects.—Nearly 11,000 apple seedlings varying in age from 6 months to 5 years have been accumulated in carrying on the project on apple breeding. Reciprocal crosses of several varieties were repeated during the year, and a beginning was made on a study of possible correlations in these seedlings. The leaf characters appear not to become differentiated until the seedlings are about one year old. In connection with this work, numerous tests of self-fertility were made by the use of paper bags and by surrounding trees with cheesecloth. The hybridization work in connection with this project is practically completed, and attention will now be given chiefly to a study of correlations among the numerous seedlings which have been produced.

In the study of the gluten content of wheat the first stage of the work, or an investigation of the milling qualities of dry-farmed and irrigated wheat collected in various parts of the State, has been practically completed. This work had been continued for three years. It was found that cultivation has a marked effect on the quality of the wheat and that the soil is a large factor in this problem. Active efforts are now being put forth to ascertain what factors have a specific influence on the gluten content. A close relationship between available soil nitrogen and the protein content of maturing grain seems to be well established.

The resignation of the bacteriologist and the appointment of a new man for this work brought about a number of modifications in the project on the bacteriological study of soil. Some preliminary work was done in examining the soils of cut-over lands in the northern part of the State for the purpose of learning more definitely the nature of the problem to be attacked.

The study of the duty of water in plant growth was carried on in the greenhouse at Moscow during the winter and at Lewiston and Gooding during the growing season. For this purpose 14 galvanized-iron tanks were used, holding about 275 pounds of soil each. Determinations are being made of the amount of water used at various stages of growth. The experimental plants were peas, wheat, potatoes, and sugar beets. This was the third year of this investigation, but the data are not yet ready for publication.

Soil colloid studies were continued, especially in connection with so-called slick spots which have been found to contain a larger percentage of colloid than the surrounding soil. Chemical analyses were made of the soils upon these slick spots in which silica, iron, alumina,

calcium, magnesium, sulphur, phosphorus, potash, total alkalis, colloids, and organic matter were determined. Barnyard manure was found beneficial in improving the physical properties of the colloidal soils, but sulphuric acid was apparently without effect. It had been applied under the assumption that it might transform calcium carbonate to calcium sulphate. Active work was started on the new project relating to the factors involved in the ripening of fruit. Special apparatus required for the conduct of this work was obtained, and preliminary work which had been done on a small scale during the preceding winter furnished many hints for the guidance of further work in elucidating the problem.

A digest of the results obtained in the study of the factors concerned in the deterioriation of butter, a project upon which work was completed during the previous year, indicated that the development of rancidity is independent of the increase in total acidity. Evidence was also obtained that microorganisms are not capable of producing rancidity or fishiness in butter and are not capable of developing in pure butter fat. Light and oxygen proved to be the active agents in the splitting of butter fat.

Work with Hatch and other funds.—The horticultural department continued its work in the canning of fruits and vegetables. The results of the experiments carried on for the past three years in the canning of fruits were published in bulletin form. An evaporator was installed, and it is proposed to study the problem of drying fruits and vegetables with reference to time required for evaporation, the loss of weight during evaporation, and the best temperature for use in this work. Experiments in winter versus summer pruning of apples were continued. Summer pruning appeared to promote an increased yield, a better color of the fruit, and an earlier harvest. Apple scab was successfully controlled with two applications of the lime-sulphur spray. Numerous variety tests with small fruits were carried on in different parts of the State, and recommendations regarding promising varieties of fruit for Idaho were published in bulletin form. The chief work of the chemical department during the year was in connection with an investigation of timber soils. The study covered samples of soil from three of the northern counties of the State and was done partly in the field and partly in greenhouses. Many determinations were also made of the organic matter in cut-over soils. In cooperation with the animal husbandry department numerous analyses were made of feeding stuffs. Studies were also carried on with alfalfa and other feeds used in digestion experiments with sheep. An investigation of the changes in oat, pea, and vetch silage was begun.

The field experiments in agronomy covered a wide variety of subjects, including variety and cultural tests with alfalfa, sweet clover,

brome grass, Sudan grass, and various forage-crop mixtures, as well as a study of Canada field peas, particularly the varieties, rate, time, and method of seeding, and mixture with other crops, particularly oats, for hay. Some of the long-standing variety tests of wheat, oats, and barley were practically completed. Comparative experiments were carried on to determine the relative yields of carrots, rutabagas, and mangels. A beginning was made in the establishment of a nursery for breeding experiments with wheat, alfalfa, and potatoes.

The dairy department maintains for experimental purposes a herd of 35 Holstein, Jersey, and Guernsey cows. An attempt is being made to determine the most economical ration for cows. The cheapest grain feed, according to the experiments carried on during the year, was a mixture containing four parts barley, two parts bran, and one part linseed meal. Corn proved to be very expensive. The problem of providing a suitable succulent ration for cows is also under investigation. Apple pomace fed to cows for a period of 40 days in rations as high as 35 pounds per day showed no appreciable effect upon the milk flow.

In the department of animal industry a sheep-feeding experiment of the commercial type was carried on, using five breeds of sheep. The comparison of the efficiency of home-grown rations for pigs was continued from the previous year. Attempts to find a cheap protein ration to add to native feeds yielded results only partly satisfactory. Striking differences were observed in the daily growth of lambs from Southdown, Shropshire, Hampshire, Cotswold, and Rambouillet ewes. The superior gains of Cotswold and Hampshire lambs is due to the greater milk production of the ewes belonging to these breeds.

The feeding experiment with poultry was begun for the purpose of devising a suitable and efficient ration for laying fowls by the use of home-grown feeds.

The following publications were received from this station during the year: Bulletins 80, Grass Pastures for Irrigated Lands; 81, Soils of the Cut and Burned Over Areas of North Idaho; 82, Canning Fruits and Vegetables on the Farm; 83, Recommended Varieties of Fruit for Idaho; and Circular 1, Spraying Calendar.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	10,136.75
Farm products, including balance from previous year	14,386.59
Total	54,523.34

In the administration of the station the plan has been adopted of requesting progress reports at regular intervals from all members of the staff and of encouraging the work of research by closer supervi-

sion on the part of the director. By means of its substations the Idaho station is in position to exercise an important influence on the agriculture of the State and to work out the important agricultural problems as they arise.

ILLINOIS.

Agricultural Experiment Station of the University of Illinois, *Urbana.*

EUGENE DAVENPORT, M. Agr., LL. D., *Director.*

In common with many other stations with a large staff and elaborate equipment, the heads of departments of the Illinois station have been given a large amount of independent authority and initiative in carrying on the work of their respective departments. The State appropriation for the use of the station during the year was $195,500, and this appropriation was allotted as follows among the different lines of work: $114,500 for agronomy, $31,000 for animal industry, $21,000 for dairying, and $29,000 for horticulture. Much effort was expended in organizing the general field work of the large station farm in such manner that operations might be carried on conveniently to all concerned.

Dr. J. H. Pettit, who was chief of the soil fertility work of the station, died December 30, 1914, and L. D. Hall, assistant chief in animal industry, resigned. Among the numerous appointments to the station staff were J. B. Andrews as animal husbandman and D. T. Englis in floricultural chemistry.

Adams fund projects.—The investigation of the cause of injury to foliage of apple trees by spraying materials led to some interesting results. A comparison was made of the effect of Bordeaux, lime sulphur, and various dust sprays. More injury resulted from Bordeaux mixture than had previously been noticed, the effect being chiefly a russeting of the fruit. These injuries were somewhat unusually severe and are believed to be due to rains, which frequently followed the application of the spray. Proprietary sulphur remedies appeared to be of little value as fungicides and caused injury to both foliage and fruit. The fruit on sprayed plats was uniformly of a higher color than that on the unsprayed plats.

The project on the transmission of characters in the apple as affected by selection and crossing was continued without interruption or change of plan. The work during the year involved chiefly bud selection, the growing of seedlings, and hybridization. Buds were taken from various parts of the tree, and the growth records compiled. As the result of seven years' work along this line no difference is indicated in growth from buds from different parts of the tree or from buds from different positions on the same twig. Likewise no difference in development was noted from small and large buds. As the

result of the hybridization work about 500 seedling hybrids have been obtained, and scions from these hybrids have been inserted in dwarf stock. In connection with this investigation some work was done in color transmission in sweet peas. The orchard in which the investigation was carried on contains about 30 species of Malus.

Work on the effect of different amounts of the same feeds on digestion, maintenance, growth, and fattening was actively continued. It is proposed to extend this work so as to determine the amino-acid content of all feeding stuffs. The investigation is now being carried on with rats and mice which receive pure amino acids, 17 kinds of amino acids being used for this purpose either alone or mixed. An attempt is being made to determine which amino acids are essential in the nutrition of laboratory animals. Experiments are in progress with pigs to compare the efficiency of corn and wheat, the cereal rations being supplemented with skim milk and distilled water. It is planned that the investigation shall ultimately be able to deal with feeds containing known amino acids.

The study of the problem of whether unit characters of mammals are independent or coupled made distinct progress. Incidentally in connection with this work many interesting practical details have been learned regarding the proper care and management of laboratory animals, with the result that very small losses are incurred in the progress of the work. The purpose of the investigation as at present carried on is to determine the cause for the extermination of certain zygotic classes in heredity and to find whether the egg and sperm can not unite or whether the young fertilized egg dies without further development. So far as the unit characters which have been investigated are concerned, it appears that these characters are not coupled to the slightest extent but are strictly independent.

The project on the effects of inbreeding has been somewhat reorganized, with the result that the problem has been much simplified and more definitely stated. The plan now involves the maintenance of two groups of inbred swine which are occasionally cross-bred to determine the effects of crossing upon vigor of offspring and also to obtain data on the size and growth of the offspring. The problem is therefore the very concrete one of determining the question whether inbreeding actually causes a loss of vigor.

Work was begun on the new skunk-breeding project, the chief practical purpose of which is to learn how to breed for a black coat which shall be long and also silky. In this work two mutants have been obtained, a pure white and a black-eyed white skunk. It has already been shown that black is dominant over albinism and that the normal skunk is completely dominant over the two mutations, albino and black-eyed white.

In connection with the study of the mathematical data collected in the investigation of heredity by the statistical method the services of a statistician were enlisted in cooperation with the department of animal breeding. In the study of the herd-book records on sheep it was found that the twinning habit is to a slight extent hereditary.

Work with Hatch and other funds.—A great variety of experiments were carried on by the horticultural department at the station and in other parts of the State. The application of fertilizer to apple trees in the southern part of the State indicated that there is no danger of overfertilization with nitrogen. Incidentally it was observed that twig growth, the amount of bloom, and the size, color, and amount of foliage vary together. There seemed to be no specific effect of different fertilizers upon the color of the fruit. In the fertilizer work with chrysanthemums, carnations, and roses it was shown that nitrogen, especially in the form of dried blood, is particularly effective in the growth of all these plants and that ammonium sulphate gave no better results than dried blood. Phosphorus appeared to be the limiting factor in the growth of roses and nitrogen in the growth of carnations. Acid phosphate was shown to have no specific effect upon the size of the roses.

The study of the effect of varying temperature in greenhouses was carried on, during which it was found that when the temperature at one end of the house was 5° F. higher than at the other the roses remained in bloom about four weeks longer at the warmer end of the house, but the flowers were larger in the cooler end. Incidentally it was found that potassium sulphate increased the flow of nectar in carnations and that the sap of plants highly fertilized with potassium sulphate contained an unusually large amount of sugar in the form of maltose.

A series of experiments was carried on in lettuce breeding, including crosses between cultivated and wild lettuce. In crossing the varieties known as May King and Grand Rapids it was found that black seed were dominant in the second generation. The leaves of Grand Rapids lettuce are pure green, while those of Big Boston and May King have red pigment. This pigment was found to be a Mendelian character and has been eliminated by breeding. Many interesting forms of hybrids were obtained by crossing with *Lactuca scariola* the wild lettuce. The continued selection of tomatoes for resistance to blight has brought out a few types which are very resistant and are being propagated for further study.

The work of the entomologist during the year was mainly of a control nature, but also involved studies of corn root aphis and San José scale. It was found that the best measures of protection against the corn root aphis are rotation of crops, early and deep plowing, and

repeated deep disking of ground which is known to be infested with the ants carrying the root aphis. Experiments with infested ripe apples showed that the San José scale might live and reproduce freely on such fruits when kept at ordinary room temperatures and that young scales might continue to appear for at least eight weeks. A comparison of lime and sulphur with two forms of miscible oils showed that the lime and sulphur has more prolonged effect when applied in spring.

In the department of soils and agronomy a large amount of work was carried on at the station and in other parts of the State. About 60 per cent of the State has now been mapped on the basis of both physical and chemical analysis of soils. The fertility work of the station involves also the use of 40 experiment fields in various parts of the State, most of them owned by the institution. On the station farm the chief soil work included a study of lime from dolomitic and other limestones, crop growth from fertilizer residues, nitrification and ammonification, the value of radium as a fertilizer, breeding experiments with cereals, and other related lines of work. In order to gain evidence on the value of radium as a fertilizer, this element was added at a cost of $1, $10, or $100 per acre. This work was continued for two years, and a study of 6 experiments with corn and 18 with soy beans indicates no effect from the use of radium.

Pot experiments were undertaken to learn to what extent the so-called insoluble residue of potash in the soil could be taken up by plants. It was found that plants are able to make available and take up this potash to a considerable extent. Apparently a natural supply of potash is liberated in considerable quantities by the decaying of organic matter.

A study of the amount and distribution of nitrogen in certain legumes, particularly soy beans and cowpeas, showed that about 74 per cent of the nitrogen of these plants at the time of harvest is in the tops, that the fixation of nitrogen takes place at a very early period in the growth of the seedlings—sometimes within 14 days, and that plants during that time contain no ammonium, nitrites, or nitrates.

An investigation of tillage of corn as related to soil moisture brought evidence that a deep, well-prepared seed bed is essential for aeration, proper root development, and conservation of moisture, but that deep tilling during the growth of corn is not to be recommended. Apparently the proper depth of cultivation is just sufficient to kill the weeds.

In the animal-industry department work was carried on in feeding hogs, on the cost of maintaining horses, and in feeding sheep. In fattening hogs for market rations of alfalfa, alfalfa and rape, and rape alone, with supplements of corn and tankage were used. The

results of the experiment are not yet ready for publication. A study of the relative cost of maintaining horses and mules for farm labor has been in progress for two years. This work is not considered as having come to a satisfactory conclusion. In the sheep-feeding work particular attention was given to raising lambs for market under corn-belt conditions. Different lots of lambs are maintained under dry-lot conditions with bluegrass pasture and with green feed. It was found that an acre each of rape, rye, and alfalfa gave more feed than 4½ acres of bluegrass.

The dairy work of the station during the year included a dairy survey in the northern part of the State, involving a study of milk production and of various dairy products from an economic standpoint, a study of cost accounting on dairy farms, the use of milk substitutes in raising calves, the bacteriology of milk, and the progress of milk inspection. In comparing various milk substitutes with whole milk in feeding calves it has been found desirable to continue the sour-milk feeding to at least four months of age.

The station is cooperating with the New York State station in an investigation of the bacterial contamination of milk. The Illinois station is studying the influence of utensils on the germ content of farm milk, while the New York State station is devoting its energies to a study of the influence of the dust of stables.

In connection with the study of problems of milk inspection and examination an investigation is being made of reductase with reference to its value in judging milk. Incidentally it was shown that both hydrogen sulphid and hydrogen alone may decolorize methylene blue, but that only hydrogen can decolorize methylene blue in milk.

The following publications were received from this station during the year: Bulletins 155, abstract, Fertilizer Experiments with Muskmelons; 166 (with abstract), A Review of American Investigations on Fattening Lambs with Special Reference to the Protein and Energy Requirements; 167, Proportions of Shelled Corn and Alfalfa Hay for Fattening Western Lambs; 168 (with abstract), A Study of the Development of Growing Pigs with Special Reference to the Influence of the Quantity of Protein Consumed; 169 (with abstract), A Study of the Ash Content of Growing Pigs with Special Reference to the Influence of the Quantity of Protein Consumed; 170 (with abstract), Coefficients of Digestibility of Some Common Rations for Swine; 171 (with abstract), A Study of the Phosphorus Content of Growing Pigs with Special Reference to the Influence of the Quantity of Protein Consumed; 172 (with abstract), A Study of the Digestibility of Rations for Steers with Special Reference to the Influence of the Character and the Amount of Feed Consumed; 173 (with abstract), A Study of the Forms of Nitrogen in Growing Pigs with Special Reference to the Influence of the Quantity of Protein Consumed;

174, An Efficient and Practicable Method for Controlling Melon Lice; 175 (with abstract), Experiments in Onion Culture; 176 (with abstract), The Use of Commercial Fertilizers in Growing Carnations; 177, Radium as a Fertilizer; 178, Recent Illinois Work on the Corn Root Aphis and the Control of Its Injuries; Circulars 160 (also revision), Some Common Spray Mixtures; 172, The Blight of Apples, Pears, and Quinces; 173, Onion Culture; 174, Testing for Fat in Milk by the Babcock Test; 175, Economic Factors in Cattle Feeding—IV, Cattle-Feeding Conditions in the Corn Belt; 176, Practical Help on Landscape Gardening; 177, The Relation Between Yields and Prices; 178, A Crisis in the Foot-and-mouth Disease Situation; 179, Four Aphids Injurious to the Apple; Soil Reports 7, McDonough County Soils; 8, Bond County Soils; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	195,000.00
Farm products	47,477.18
Balance from previous year	34,351.76
Total	306,828.94

The equipment of the Illinois station is increasing at a rapid rate. The large staff has necessitated a rather sharp differentiation between investigational and administrative work, the younger men for the most part carrying on the actual work of investigation. Through its numerous experimental fields the station is in intimate touch with the farmers of the State.

INDIANA.

Agricultural Experiment Station of Indiana, *Lafayette.*

ARTHUR GOSS, M. S., A. C., *Director.*

The controversy concerning the State appropriation for the station is still unsettled. The matter was referred to the circuit court, and this court decided in favor of the claims of the station and university authorities to the effect that the standing appropriations to the station were not superseded by the mill-tax plan adopted for the general support of the institution. The case has been appealed to the appellate court and is still awaiting decision. Under these circumstances some retrenchments became necessary in the expanding plans of the station for new work. The State appropriation for the station for the year was $91,000, being made up of a State agricultural experiment fund of $75,000, a fund for investigating swine diseases of $15,000, and $1,000 for creamery license work.

Only a few changes occurred in the station staff. The resignations included J. B. Abbott, associate in soils; D. O. Thompson,

associate in animal husbandry; and R. O. Bausman, assistant in creamery inspection, and the new appointments included S. C. Jones, assistant in soils, and H. C. Mugg, deputy State chemist.

Adams fund projects.—The project on apple-orchard management in relation to soil moisture, soil temperature, tree development, and fruit production made satisfactory progress. Weekly records are kept of the temperatures of the air and soil, of rainfall, and of various other data regarding the growth of the trees in height, measurement by circumference, and time of flowering and fruiting. The soil moisture is determined at a depth of 9 inches four times during the season. The lowest percentage of soil moisture was found in the plats under sod and the highest in straw plats. A heavy application of the complete fertilizer showed no effect on the conservation of soil moisture. It appears that the optimum moisture content of the soil in the experimental orchard is about 20 per cent. In connection with this work a new apparatus has been devised for taking soil samples for bacteriological analysis, and also a Kjeldahl flask which does not bump. Determinations are also made of the rate of nitrification, ammonification, and rate of nitrogen fixation. It has been found that the mean monthly soil temperatures vary most under clean culture.

In the project on rusts the botanist continued his description of species of rust which have been received from various localities, and these descriptions are published from time to time in technical journals. The general publication on cereal rusts in addition to the systematic monograph of rusts is in progress. The botanist in charge of this project has been made professor emeritus and will devote all of his time hereafter to an investigation of rusts.

The study of hog-cholera virus involved a continuation of an attempt to attenuate virulent blood by mixing with serum, then cooling, and then subjecting to different temperatures from 50° to 65° C. No success attended these efforts. There appears to be no attainable halfway condition; the virus remains either completely virulent or completely nonvirulent, and there seems to be little hope of getting a vaccine from virus by heat. Considerable work was done upon the determination of the virulence of the blood at different periods of the disease. The blood was found to be most virulent on the seventh and eighth days, and the incubation period, in the case of the most virulent blood, was four or five days. No medium has been found in which the ultramicroscopic cause of hog cholera may be cultivated. More than 100 sterile filtrations of virulent blood and salt solution have been examined by the dark field or ultramicroscopic methods. Thus far all attempts to isolate a specific microorganism from virulent blood and blood filtrates have failed.

The study of pasteurization of gathered cream in relation to the bacterial flora and keeping quality of butter led to some interesting results. Butter was made from cream pasteurized at 140°, 165°, and 180° F. Pasteurization at 140° was by the holding method, and at 165° by the flash method. No differences were observed in the effects of temperature at 165° and 180°, but all results showed that the best butter comes from pasteurization at the highest temperatures. The increase in acid in the butter is less, as well as the disintegration of protein. In cold storage it was also found that the condition of the butter was better as the temperature of pasteurization was raised. The efficiency of pasteurization appears to vary with the bacterial flora of the cream and with the season of the year. A pasteurizing temperature of 185° F. or higher was found to injure the quality of the butter.

Work with Hatch and other funds.—In the department of soils and crops a great variety of experimental work was carried on. A program of permanent experimental work in soil improvement has been established on the Wilson farm near La Fayette, on plats which have been tile drained and carefully prepared. This series of experiments includes 10 rotation plats. The crops used in these rotations include alfalfa, sweet clover, and other legumes, with cereals and corn. The plats are one-half acre in size. A four-course rotation system has been established to compare grain-farming with stock-farming methods. Miscellaneous fertilizer experiments are also under way. On the corn-breeding plats an attempt is being made to determine the effect of sucker production. It appears that the sucker production is hereditary and can be increased, and that the yield of grain is also increased with the increase in suckers. The possibility of increasing the yield of corn by the ordinary selection method appears to be strictly self-limited.

A study is being carried on to determine the effects of varying degrees of soil acidity upon the development of legumes and upon their ability to fix nitrogen. In a comparative study of the chemical composition of virgin and cropped soils, it was found that with most soil ingredients the differences were not sufficiently great to be of practical importance. The most serious losses in cropped soils were of nitrogen and organic matter. A study of acid soils as to the effect of acid phosphate and other fertilizers upon them indicated that the acidity which has developed when acid soils or silicates are treated with neutral salt solutions is probably due to a chemical exchange of bases. It appears that much of the harmful acidity of soils is due to the toxic salts of aluminum and iron.

The general work of the department of horticulture included cover-crop investigations, spraying of peaches, pruning tests with apples, variety tests with strawberries and bush fruits, phenological

observations on orchards, and a study of the diseases of cucumbers. The pruning experiments on apples involved a comparison of the two systems of open head and central leader. The experiments were begun on young trees and will be carried on long enough to determine the effect of these systems on the growth of the trees and the yield of the fruit.

The comparative freedom of peach trees from disease during the year interfered somewhat with the experiments on the effect of self-boiled lime sulphur and atomic sulphur in controlling brown rot. *Bacterium pruni* appeared on fruit trees for the first time in Indiana. The cover-crop work included the study of German millet, winter vetch, cowpeas, rye, and other crops. Thus far rye and German millet have given the best results. Bare ground was found to freeze to a depth of 18 inches, while the soil under rye was found to freeze to a depth of only 7 inches.

The energies of the department of animal husbandry were largely devoted during the year to experiments in feeding beef cattle, hogs, sheep, and poultry. This was the ninth year in the series of cattle-feeding experiments. It was shown that cottonseed meal is best fed in rations of 2½ pounds per thousand pounds of live weight. Soy-bean meal fed as a supplement to corn proved to be rather unsatisfactory on account of its high oil content. Clover hay was shown to be fully equal to alfalfa hay as roughage. Commercial molasses, although relished by cattle, gave very unsatisfactory results. In experiments in sheep feeding, timothy hay was found unsatisfactory for lambs, causing in many cases constipation and autointoxication. Lambs were found to be extremely sensitive to unbalanced rations. In these experiments clover hay proved to be 50 per cent more effective for lambs than timothy hay. Silage appears to be a cheap and effective feed for lambs, but is not eaten in large enough quantities. It caused a reduction of 30 cents per hundred pounds in the cost of mutton. Cottonseed meal as a food for lambs gave good results when fed with corn in proportions varying from 1 to 4 to 1 to 7. A test of the value of tankage for hogs was repeated on practically the same basis as the experiment of the previous year. The results indicate a large financial loss from the use of tankage.

The botanical department carried on numerous tests with formaldehyde as a treatment for oat smut and potato scab. An automatic sprinkling apparatus for applying a formaldehyde solution was used with excellent results. Hydrogen peroxid gave poor results as a treatment for wheat smut. Some work was done in the control of injurious fungi in soil as a system of soil sanitation. In connection with a plant-disease survey, information was collected on the common diseases of alfalfa, wheat, cabbage, grapes, potatoes, and other crops. Some attention was also given to methods of destroying weeds, particularly wild garlic, Canada thistle, and red sorrel.

The work of the veterinary department, in addition to its Adams fund project on hog cholera, included a sytematic test of proprietary remedies for hog cholera, the preparation of hog-cholera serum on a large scale, and the beginning of a study of infectious abortion.

The general work of the dairy department included a study of milk substitutes in calf feeding, a comparison of alfalfa and soy-bean hay for cows, a study of methods of cooling milk on farms, and creamery inspection work. For the most part proprietary calf feeds gave poor results. In an investigation of the influence of cottonseed meal on the breeding powers of dairy heifers it appeared that little, if any, effect was attributable to this feed.

The attention of the entomological department was largely directed to a study of the codling moth, Hessian fly, army worm, and bee-keeping. It was found that the first brood of the codling moth largely enters the apple through the side rather than through the blossom end. The Hessian fly was unusually abundant, and a second brood occurred during the fall. This brood passed the winter in the larval stage, and the adults appeared in June of the following year.

As in previous years, the chemical department carried on State-control work in connection with the chemical examination of feeds and fertilizers. This work involved a great number of chemical determinations, and much routine analytical work was also done in cooperation with the department of animal husbandry in its experiment in feeding cattle.

The following publications were received from this station during the year: Bulletins 170 (popular edition), The Reclamation of an Unproductive Soil of the Kankakee Marsh Region—Soil Acidity, Nitrification, and the Toxicity of Soluble Salts of Aluminum; 175, Composition of Maize at Various Stages of Its Growth; 176, Wild Garlic and Its Eradication; 177, Commercial Feeding Stuffs; 178, Cattle Feeding, X; 179, Sheep Feeding, IV; Circulars 44, The Prevention of Hog Cholera in Indiana; 45, Stallion Enrollment, II; 46, Stallion Enrollment, III, Report of Stallion Enrollment Work to Date of October 31, 1914; 47, Stallion Enrollment, III, Renewals for 1915; 48, Notes on the Hog-cholera Conference at Purdue University, December 18, 1913; 49, Farm Manures; 50, The Creamery and Testers' License Law; 51, How to Produce Cream that Makes Good Butter; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	91,000.00
Fees, including balance from previous year	97,691.43
Miscellaneous, including balance from previous year	168,613.64
Total	387,305.07

The station is occupying a more and more effective position in helping the development of agriculture in the State. The great expansion of station work in various lines has necessitated some changes in organization, in order to bring the work of the station into most effective operation. During this readjustment much extra work of an administrative nature has fallen upon the shoulders of the investigators. Perhaps the most urgent need of the station at the present time is a larger State fund specifically provided for research work.

IOWA.

Iowa Agricultural Experiment Station, *Ames.*

C. F. Curtiss, M. S. A., D. Sc., *Director.*

The work of the station during the year proceeded along the same lines as heretofore and with highly satisfactory results. All the work of this station is on a project basis, and the projects are kept on file for convenient reference. In the State appropriation the research of the station suffered a little as compared with extension work, but this is considered to be merely temporary, since the need of support for research work is fully appreciated. The station received a State appropriation of $106,300. The plant laboratory and the new greenhouses were provided with quite full equipment. A number of minor changes occurred in the station staff, and H. E. Summers, station entomologist, was given leave of absence. A station editorial committee was appointed to consider and critically examine all manuscripts for publication by the station. This committee appears to be well organized and is bringing good results in the form and structure of station bulletins.

Adams fund projects.—In the project on Mendelian unit characters in cattle breeding the work assumed a more definite direction than had hitherto been the case. During the breeding work incidental to this project 4 mature cows and 23 calves of the second generation have been secured. Some of the animals of the second generation have been crossed back on Shorthorns of different colors. Various points in the inheritance of Mendelian characters are illustrated in the second generation. A large mass of records has been accumulated, which will be published in bulletin form in the near future. All white offspring thus far obtained have black ears.

The study of organic matter of the soil under different systems of soil management, with reference to changes which take place in the humus, led to the development of a more accurate method for determining amino acids. Various kinds of nitrogenous bodies are added to the soil for the purpose of testing the accuracy of methods in extracting different groups of nitrogen, studies being made of the rate of decomposition of humus as measured by the production of

carbon dioxid. Ammonium sulphate without lime caused a greater evolution of carbon dioxid than the nitrate of soda. Samples of air taken from 8 inches beneath the soil showed most carbon dioxid in plats which received 4 tons of manure per acre. In this investigation the amount of ammonia extracted by hydrochloric acid appeared to be independent of the strength of the acid and the period of extraction, while the amount of ammonia obtained by distillation of the soil directly with magnesia was dependent upon the duration of the period of distillation. The quantities of ammonia obtained by examination of the hydrochloric-acid extract were lower, and the quantities obtained by direct distillation with magnesia were higher than those obtained by the aeration method.

Humus and its relations to the physiological activities of the apple received much attention during the year. The weights of leaves were taken from each plat in the orchard, and it was found that the green and dry weights of leaves were greater on the cultivated than on the sod plats. The percentage of moisture was greater in the leaf from the cultivated plats, but the total dry weight was also greater. In measurements of the twig growth and the circumference of the tree trunk it was also found that the greatest increase had taken place on the cultivated plats. The color of the fruit appeared to be highest on the sod plats and the size of the fruit was greatest on the cultivated plats.

In continuing the project on apple breeding, which was started in 1907 and which now includes 300 varieties of apples, an attempt was made to establish pedigrees and to learn what are unit characters. It appeared that sweet flavor is one unit character. An effort is being made to correlate the texture of the twigs and the hardiness of the trees. The structure of the twigs appears to be definitely related to hardiness.

Considerable progress was made in the study of the influence of feed, environment, and breeding on native, unimproved cows and on their offspring. During the course of this work the average milk production of the original cows and of their progeny has been tabulated. A considerable increase is noted both in the quality of milk and of milk fat. The record of the Holstein-Arkansas and Guernsey-Arkansas crosses now cover from two to four years. The project has thus far been concerned chiefly with problems of practical breeding and improvement. The underlying problem involved in the investigation is now more apparent, and the project will henceforth take a more restricted and definite course.

Work with Hatch and other funds.—The department of farm engineering made studies of farm buildings for the purpose of developing a better system of permanent construction. The depreciation of wooden buildings is believed to be too great, and methods of water-

proofing are being tested. Asphalt gave the best results for this purpose. A comparison of tar, cement wash, and cement plaster as an inside finish for clay blocks in water tanks gave results in favor of cement plaster. Tar was found to peel off and become fluid at temperatures which sometimes prevail in silos. It was found that about three weeks after filling silos the temperature runs up to 180° F. Tests were also made of silage cutters. It appeared that from 35 to 40 horsepower on the belt is required for the most effective work. As a rule, 1 horsepower per inch on the cutter per ton per hour seems to be the required power. In tests of roofing 32 kinds of material were used, of which materials with an asphalt base proved to be the most durable. Other experiments are under way in systems of drainage, farm sewage, heating, lighting, and power on the farm, and a comparison of various kinds of fence posts.

The department of animal husbandry carried on a number of experiments, including a comparison of hand feeding and self-feeders for pigs, methods of fattening brood sows, and comparisons of dry lot versus forage for sows, the wintering of brood sows, feeding sheep, and the study of the economy of producing baby beef. There appears to be no economy in feeding old sows for long periods. Self-feeding devices produce more rapid and more economic gains with all kinds of forage and concentrated feed for pigs. Excellent results were obtained from feeding sows corn, buttermilk, and tankage before farrowing, and continuing the same ration even after the young pigs have access to the same feed. In one instance a young pig was brought to the weight of 90 pounds at the age of 79 days. In order to prevent overfeeding on grain it was found desirable to mix alfalfa with the corn. An experiment was begun to determine how much silage can be fed economically to baby beef. In cooperation with the agricultural engineering section a study was made of methods of constructing and handling movable hog houses.

The horticultural section carried on a number of lines of experimental work, including grape pruning, soil management for grapes, the rejuvenation of old orchards, a study of seed potatoes, spraying apples, methods of heating orchards, cold storage for Iowa apples, the management and fertilization of orchards, and a truck-crop survey. It was found possible by a proper system of pruning to increase the yield of Moore Early and Concord grapes about 48 per cent. For use in its work on cold storage of apples the horticultural department now has a good cold-storage plant in connection with the horticultural laboratory. Preliminary experiments indicate that truck gardening under glass can be conducted profitably in the Iowa climate.

The forestry work of the station was carried on partly in connection with the engineering section and with the Forest Service of the

Department of Agriculture. This work involved a study of fence posts, methods of forest planting, and the management of farm wood lots. In experiments with various kinds of wood used for fence posts it was found that woods which rotted within 3 years when untreated kept in good condition for 10 years after treatment with creosote. The study of methods of forest planting was conducted with hardy catalpa, cottonwood, various species of pines, and other trees.

The work of the dairy section involved experiments with dairy cows and with the technical side of dairying. A series of experiments was carried on in the clarification of market milk by means of the separator. A market-milk survey was conducted to determine the condition of market milk in various Iowa cities. Bacteriological work was done on an organism which causes the coagulation of canned evaporated milk. This organism has been found to grow very slowly. The dairy section also investigated the factors which affect butter shrinkage, which determine the yield and consistency of ice cream the cost of pasteurization, and the cause of the toxicity of milk which is held for long periods. Considerable attention was also given to American high-acid organisms related to *Bacillus bulgaricus* and to bacterial flavors and odors of milk, in an attempt to determine how counts of bacteria must be found before the flavor of butter is affected. The results indicate that the number of bacteria must run into the millions per cubic centimeter before the flavor or odor of the butter is affected.

In the study of coagulation of evaporated milk it appeared that only a small percentage of the spoiled cans showed a bulging due to the formation of gas. The organism concerned in this trouble was isolated and carefully studied. It proved to be a new species which is described as *Bacillus coagulans*. An investigation of the pasteurization of cream for butter making indicated that no close relation exists between the number of living bacteria and the acidity of sour cream. Vat pasteurization of sour cream, at temperatures of from 140° to 145° F. for 20 minutes, has sometimes left large numbers of living bacteria. In pasteurizing bottled milk it was found that the process of heating in the bottle is a slow one, but that a temperature of 145° F. for a period of 50 minutes gives satisfactory results.

The dairy section also made a study of soiling crops for cows, the use of sugar in cow rations, and the rate of growth and cost of gain in cows. Milk records which have been kept on the station dairy herd for a number of years will soon be prepared for publication.

The farm-management section is carrying on a survey in which records are kept of 1,000 farms. After one year's work on this problem a special study was begun of the 40 most successful among the 1,000 farms. An investigation is also under way of land tenancy in Iowa and of the size of farms as related to economic production. It

was found that the size of farms in the State is increasing, being now 157 acres on an average.

The chemical section moved into its new building in November, 1914, and the work was somewhat handicapped by the necessary rearrangements. A study was made of methods of determining sulphur in insecticides and fungicides. Numerous analyses were made of apples, in cooperation with the horticultural department, and of forage crops, in cooperation with the section of animal husbandry. A chemical study of silage during fermentation indicated that nonreducing sugar is rapidly changed to reducing sugar, that volatile acids increase daily, that carbon dioxid develops rapidly after the silo is filled, and that free oxygen disappears entirely after the second or third day.

The section of agronomy and soils conducted numerous experiments in breeding oats, wheat, corn, and clover. Particular attention was given to sweet clover, and a scarifying machine was devised for treating sweet-clover seed. This machine operates very successfully, as shown by the fact that seed which will germinate only to the extent of 5 per cent before treatment produces a germination of 90 per cent after treatment. An effort was made to find the cause of the failure of red clover in various parts of the State. An extensive study was made of the general conditions of fertility of Iowa soils. It appears that after the acidity of Iowas soils has been entirely neutralized the use of 1 to 2 tons of lime per acre once in four or five years is sufficient to prevent the soil from becoming acid. An investigation was also made of the peat and alkali soils of the State and of sulphur oxidation in the soils. It appeared that free sulphur was oxidized much less readily in the soil than were the sulphids.

The botanical section has conducted work in clover pollination which indicated that bees are essential for seed production, and that the weather is also an important factor in this process. The plant-disease survey work was continued. This work involved a study of diseases of corn and of various other economic plants. Some attention was also given to honey plant investigation, the fertilization of fruits, and transpiration in plants.

The entomological section continued its work on the study of the life history of the strawberry leaf roller, and of cutworms, potato insects, and an aphis on the box elder.

The publications received from this station during the year were as follows: Bulletins 136, Forage Crops for Hogs; 145, The Effect of City Smoke on Vegetation; 146, Iowa Seed Analyses; 147 (with popular edition), The Codling Moth in Iowa (*Carpocapsa pomonella*); 148 (with popular edition), Effect of Potato Scab Treatments on Seed Vitality: Formaldehyde and Corrosive Sublimate Solutions and Formaldehyde Gas; 149 (with popular edition), Better Methods of

Potato Production for Iowa; 150, The Fertility in Iowa Soils; 151, Soil Acidity and the Liming of Iowa Soils; 152, Movable Hog Houses; 153, An Apple Orchard Survey of Mills County; 154, The Pasteurization of Milk in the Final Package; 155, Potato Insects. Research Bulletins 13, Bacteriological Studies of Field Soils, III; 14, The Specific Heat of Milk and Milk Derivatives; 15, A Bacteriological Study of Blue Milk; 16, Chemical Changes During Silage Formation; Circulars 18, "Iowa 403"—A New Seedling Apple; 19, The Control of Chicken Mites and Lice; 20, Making Old Orchards Profitable; 21, Corn Stalk and Corn Root Diseases in Iowa; and 22, The Hessian Fly.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	106,300.00
Farm products	19,815.91
Balance from previous year	13,420.14
Total	169,536.05

The Iowa station quite fully recognizes its important function in pursuing research work of a strictly scientific nature. The more practical problems in which the farmer requires more immediate help are not overlooked. The work of the year indicates that the station has succeeded in conducting and extending its research and practical operations in a satisfactory manner.

KANSAS.

Kansas Agricultural Experiment Station, *Manhattan.*

W. M. Jardine, B. S. A., *Director.*

The research work of the Kansas station was continued along previous lines, including studies in soil fertility, physiology of drought-resistant plants, animal nutrition, use of silage, culture and breeding of alfalfa, corn, wheat, oats, barley, and other field crops, cost of the production of draft colts, and other phases of agronomy, horticulture, entomology, and veterinary science. Work in cooperation with this department was carried on at Fort Hays, Garden City, and Colby substations in the investigation of problems of irrigation, dry-land agriculture, and the production of forage crops. About 22 acres on each of the substations has been laid out in rotation and tillage plats. At Fort Hays about 350 varieties of cereals and 230 varieties of forage crops were grown. The results of cooperative crop-improvement experiments indicated the decided superiority of home-grown varieties of corn over introduced varieties.

The State appropriation to the station, including substations, was $76,000, and the appropriations made for substation work during the coming year were still more generous. The State appropriation for

the use of the main station involved an increase of $10,000 over the previous appropriation.

Adams fund projects.—The study of climate as related to injurious insects involved the close cooperation of the entomological and zoological departments. Much attention was given to an investigation of the life history of the Hessian fly under field conditions and in chambers affording complete control of temperature and moisture.

The study of the life history of the chinch-bug egg parasite was continued actively and led to the establishment of a large mass of data relating to the stages in the life of this insect, the time of emergence, distribution of the parasite, length of the life cycle, the number of generations, and effect of temperature and food upon the parasite. Temperatures of from 40° to 50° F. were found to prolong the life cycle from 15 days to 42 or more days and also to prolong the length of adult life from 10 days to as many as 78 days. It was found to be easily possible to feed the parasites successfully on sweetened water, sap from cornstalks, and gum secretions from sunflowers.

In the investigation of inheritance in certain Orthoptera several species of grasshoppers were used. It was found that the color pattern appears to meet Mendelian expectancy, although certain variations have been observed. In this study a special chamber for the control of temperature and moisture was devised to determine the effect of various temperatures upon the germ plasm. In this apparatus it has been found possible to produce five instead of the usual four generations of Paratittix. At least two new unit characters have been found in this study.

The belief that the fowl nematode *Heterakis perspicillum* may be transmitted by earthworms was strengthened by results obtained during the year. Experiments indicated, however, that it is a case of association rather than of parasitism. Further work will be done in an effort to determine more definitely how fowls are infected with nematodes and how earthworms may serve as the carriers of these parasites. It was shown in a study of the chick tapeworm that rabbits infected with tapeworm cysts might be fed to fowls without danger of infestation.

In connection with the investigation of cerebritis in horses feeding experiments with moldy corn gave negative results. Numerous examinations were made of pathological material to determine the nature of the lesions. Further work on this subject will be required to elucidate the cause of the disease.

In the investigation of the influence of nutrition upon the form of growing animals experiments were conducted on steers and pigs. In the case of pigs an effort was made to determine the effect of corn on the growth of young animals. During the year the fifth series of experiments to determine the deficiencies of corn as a ration for young

pigs was completed. It is believed that another year's work will bring to a conclusion these studies on the effect of food on growing cattle and hogs.

Thus far no appreciable differences have become manifest in the condition of horses fed alfalfa hay cut at different stages of growth. This work will be continued, however, in order to gain a more certain basis for a definite conclusion.

In the breeding of alfalfa 63 additional strains were added to those already under investigation in the development of a drought-resistant alfalfa. Numerous crosses were made between species of Asiatic alfalfas which were resistant to cold and various strains of common alfalfa. During the year about 100 crosses were made and 29 hybrids produced for use in the investigation.

A beginning was made in the study of sex type as related to functional development and performance. An examination of herdbooks showed rather clearly that the selection of Shorthorn cows has previously been made upon a wrong basis, and that prize-winning cows are seldom or never the mothers of prize-winning animals.

Work with Hatch and other funds.—In the dairy department a study was begun to determine the relative value of silage made from corn with and without ears. The principal agents of fermentation in silage were shown to be microorganisms and not enzyms in tissue cells. Sweet sorghum proved to be a very palatable silage for cattle. A study of alfalfa silage was begun in cooperation with the departments of bacteriology and chemistry. Data on the capacity, temperature of fermentation, and other points in connection with various kinds of silos were accumulated for further study. In this work six small silos were constructed for the special purposes of the investigation. An experiment was also set in operation to determine the effect of various rations fed to heifer cows upon the growth of the calves.

The miscellaneous entomological work of the station included a study of methods for the control of various insect pests. The use of a poisoned bran mash, to which a small quantity of orange or lemon juice was added, was found to be very effective in the control of grasshoppers, army worms, or cutworms, and was also found to be without danger to birds or poultry if it was spread broadcast over the infested area. Investigations were continued on methods for the practical control of chinch bugs under field conditions. The results of this study are nearly ready for publication. Observations were also made on the life history and methods of controlling the corn-ear worm, red spiders, plant lice, corn billbug, Kafir ant, and other injurious insects.

The bacteriological work of the station included a study of the accumulation of nitrates in certain experimental plats in an effort to

determine the causes of fluctuation of nitrates. Work was also done on certain infectious diseases, particularly roup and sorehead of fowls, and upon the bacteriology of eggs. The bacteriological department cooperated with the chemical and dairy departments in a study of the bacterial flora of silage, and also of various grades of flour.

Much of the time of the veterinary department was occupied with the manufacture and distribution of hog-cholera serum. Some attention was given to methods of testing vaccines for the control of blackleg. A kind of serum considered to be of unusual excellence for this purpose was devised by the station. Much attention was given to an investigation of various sources of serum, with the idea of learning how to reduce the cost of manufacture and how to improve its efficiency. During the year the station distributed 79,000 doses of single blackleg vaccine, 65,000 doses of double blackleg vaccine, and 2,900,000 cubic centimeters of hog-cholera serum.

The activities of the chemical department were concerned with studies of different flours in an attempt to find methods for showing small changes in protein content. It was found that of two loaves of the same volume the one which shows the greatest oven spring possesses the stronger, stiffer gluten. The proteins of wheat flour appeared to influence strongly the baking qualities of the flour, but this matter involves other factors than the mere ratio between gliadin and the rest of the proteins. The poorer commercial grades of flour were shown to possess a greater acidity, but the increasing acidity was accompanied by an increase in water-soluble phosphates. The chemical department also made numerous analyses of commercial fertilizers and of various materials under study by other departments of the station.

The poultry work was largely confined to an experiment in grading up a strain of poultry by the use of pure-bred males. This work has been continued for three years, with the result that a very uniform strain of chickens has been produced. A beginning was also made in the study of methods of precooling poultry for shipment by parcel post.

The general animal-husbandry work under the Hatch fund consisted largely of feeding experiments. A test of the feeding value of silage for calves was repeated for the third time and duplicated at the Hays substation. Cheaper growth was produced in colts with corn, bran, and linseed meal than with oats. A beginning was also made in the study of the cumulative effect of ancestry, Berkshire and Duroc hogs being crossed to furnish material for this investigation.

The general work of the agronomy department was very extensive, covering some phase of practically all important field crops adapted for growth in the State. The work involved a study not only of the individual crops, but also of the effects of rotation and methods of

crop improvement. The indications obtained from a series of fertility tests were that phosphorus was one of the limiting factors in the increase of fertility on the station farm. In a study of the relation of moisture to the yield of winter wheat it was shown that ground plowed late in the fall contained 2.7 per cent of available moisture at seeding time, ground plowed in the early fall 4.2 per cent, and summer-fallowed ground 8.8 per cent.

The horticultural investigations of the station included experiments in the management of orchard soils, systems of pruning with reference to their effect on bud formation, spraying for the control of insect and fungus pests, a comparison of local and northern potatoes for seed, and cultural studies of watermelons, tomatoes, grapes, and other fruits. The results obtained with potatoes indicated that northern seed is cheaper than local seed, for the reason that the latter must be held in cold storage before planting.

The botanical work of the station in addition to the Adams fund project on alfalfa breeding included corn breeding for the production of resistant varieties and breeding of cereals for resistance to fungus diseases. One strain of corn of remarkable drought resistance was originated. The relation between drought resistance and the amount of water transpired per unit of dry matter, and the relation of root system, leaf area, and leaf structure are also being investigated. A histological study is being made for the purpose of determining the cause of immunity of milo maize to smut and the relative susceptibility of other sorghums to this disease.

The publications received from this station during the year were as follows: Bulletins 198, Kafir in Field and Feed Lot; 199, Chemical Analyses of Some Kansas Soils; 200, Soil Survey of Shawnee County, Kans.; 201, Some Factors Influencing the Bacterial Content and Keeping Quality of Eggs; 202, Kansas Flours—Chemical, Baking, and Storage Tests; 203, Orchard Spraying; Circulars 38, The Kansas Feeding Stuffs Law Revision of 1913; 39, Cream Grading for Kansas; 40, Suggestions that Will Assist in the Prevention and Control of Hog Cholera; 41, Actinomycosis or Lumpy Jaw; 42, Which Stallion and Why; 43, The Pocket Gopher; 44, Sweet Clover; 45, Dairy Farming; 46, The Spring Cankerworm Situation in Kansas; 47, Insects Destructive to Grain and Grain Products Stored in Bins and Granaries; 48, Raising Calves on Skim Milk; and 49, Pruning.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$14,995.00
Balance from United States appropriation, Hatch fund	5.00
United States appropriation, Adams Act	15,000.00
State appropriation	76,318.74
Fees	22,324.74
Total	128,643.48

The research work of the Kansas station is being prosecuted actively with important results, under stable conditions of organization of the station staff. The scientific work of the station also becomes more and more tangible to the farmers of the State as a result of the policy of carrying on fertility, rotation, and animal-husbandry experiments at all of the substations.

KENTUCKY.

Kentucky Agricultural Experiment Station, *Lexington.*

J. H. Kastle, Ph. D., *Director.*

There was little or no change during the year in the nature or course of the experimental work at the Kentucky station. The inspection work has been practically segregated so that it does not appear to interfere with investigation. Among the improvements at the station mention should be made of the construction of roads through the farm so as to make all parts more accessible to the members of the station staff as well as to visitors. B. D. Wilson, assistant chemist in the fertilizer department, and C. B. Wilson, assistant in the hog-cholera-serum laboratory, resigned, and E. W. Mumma, in charge of hog-cholera-serum production, died December 4, 1914. L. R. Himmelberger was appointed assistant in hog-cholera-serum production, and M. J. Smith and E. Huston assistants in animal husbandry. The State appropriation for the use of the station was $50,000. Relatively large sums were also received from the sale of hog-cholera serum, farm products, and fees for the inspecting of feeds and fertilizers.

Adams fund projects.—In the investigation of the nodule organism of alfalfa and its relations to those of sweet clover and red clover much information was obtained relating to the classification of these bacteria and also regarding practical methods of growing plants in test tubes for purposes of observation as to the activities of nodule organisms. Particular attention during the year was given to the study of the nodule organisms of the black locust. For this purpose young plants were grown in test tubes. Nodules appeared at a very early stage of growth, and the bacteria were apparently different from those on herbaceous legumes. A bulletin on the subject of nodule bacteria was published by the station.

The project on the corn earworm was practically completed, and a bulletin on the life history and habits of this insect was issued. The work of the station during the year on this subject was concerned chiefly with methods of control, such as the use of sirups, light traps, and flytraps. Some attention was also given to the parasites of this pest.

Work on the locust borer was carried on actively. It is hoped that the life history of this insect will be completed during the com-

ing year. Observations thus far made on this insect indicate that the adults feed almost exclusively on certain plants, and if this observation is confirmed it may give rise to a new and more effective method of attacking the locust borer.

In connection with the study of contagious abortion efforts were directed largely to the matter of working out a practical method of prevention or cure. For this purpose a bacterin and serum have been tested without very satisfactory results. The use of serum, however, appeared to bring about a hyperimmunized condition and may lead to a satisfactory method of control. In laboratory work with rabbits it was found that these animals could be immunized to the extent of enduring ten times the lethal dose for untreated animals. The use of methylene blue gave satisfactory results in treating cows for contagious abortion. Hexamethylenamin gave almost as good results and is much cheaper than methylene blue. Incidentally it was found that infectious arthritis in colts is due to the same organism that produces infectious abortion in mares. It was also observed that infectious arthritis in colts is usually found in herds of horses in which infectious abortion has occurred.

The year was not favorable for the study of clover bloat, since very little of this trouble appeared during the season. The principal sugar in white clover blossoms was found to be glucose, accompanied probably by xylose and arabinose.

In the method of rendering insoluble silicates of potash available by the action of soil bacteria and yeasts considerable success was attained from the use of brewers' yeasts. It was not definitely shown, however, whether the action was due to the yeast or to the carbon dioxid set free by the yeast. This project involves cooperation with the chemical department, and a great number of chemical determinations are required before the project can be brought to a close.

Considerable progress was made in the study of sulphur in its relation to permanent soil fertility. This work was continued on nine types of soil in greenhouses, and sulphur was applied only in the form of flowers of sulphur. The experimental plants were soy beans, clover, and alfalfa. No apparent correlation was found between the sulphur in the soil and the response in the soil to sulphur. In fact, the results thus far obtained indicate that the effect of sulphur is very different in different soils, and some caution must be exercised in reaching a conclusion as to the fertilizer value of sulphur. An analysis of 31 varieties of tobacco showed that only two contained less sulphur than phosphorus. Sulphur added to the soil upon which soy beans were grown caused a decided increase in the growth of these plants. Turnips were materially benefited by sulphur, but clover seemed to show no effect. It has been found that sulphur after being added to the soil is rapidly oxidized to a sulphate.

In a study of the occurrence and distribution of manganese in plants particular attention was given to the function of manganese. The manganese appears to be located chiefly in the seed coat of various plants. Since the seed coat reacts strongly to oxidases while the cotyledons do not, it was thought that the manganese in the seed coat assists in stimulating various enzyms. A satisfactory method for determining manganese in soils has been devised and will soon be ready for publication.

The study of barium was continued in pot cultures of clean river sand in the greenhouse, using corn as the experimental crop. Analyses were made of the roots, stalks, and leaves separately. Very little barium was taken up, and most of it was deposited in the roots and stalks. Barium appears to have some catalytic effect. Incidentally it was found that considerably more strontium than barium is taken up by the plants.

The study of the translocation of mineral matters in plants was continued with corn and potatoes. The seed of these experimental plants is grown in the greenhouse in distilled water without supplying any plant food. It is germinated under conditions in which bacteria are excluded and is then placed on cotton plugs in test tubes coated with paraffin to prevent the roots from coming in contact with the glass. It was found with beans that they would reach a height of about 7 inches under these conditions. The plants were divided into five parts, and determinations were made of phosphorus, calcium, magnesium, potash, and silicate in each part. It was found that 40 to 45 per cent of all the elements were left in the cotyledons and that nearly one-fourth of the mineral matter went to the leaves. In experiments planned for the future it is proposed to add nutrients to the solutions.

Work with Hatch and other funds.—The work along the line of animal industry under the support of Hatch and State funds included a study of the heredity of coat color in horses, of infertility of stallions and brood mares, feeding experiments with dairy cows, comparison of poultry breeds for egg production, feeding experiments with pigs, and the use of silage in finishing beef cattle. In a comparison of distillers' dried grains and corn meal for pigs on pasture it was found that on the corn meal the pigs made more than twice as large an average daily gain as on distillers' dried grains. In studying the feeding value of wheat for pigs it was shown that when pork had a value of $8.50 per hundredweight, ground wheat produced a profit of 9 cents a bushel more than whole wheat. Quite a mass of data was collected on the details of handling and cleaning the milking machines and on the relationship of these machines to milk sanitation.



FIG. 1.—TILE SILO IN CONNECTION WITH BEEF-CATTLE BARN, KENTUCKY STATION.

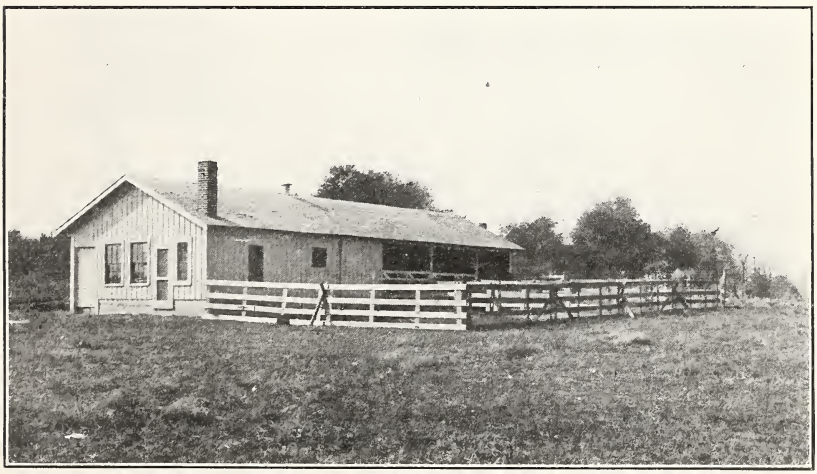


FIG. 2.—SHEEP BARN AND FEED YARD, KENTUCKY STATION.

The horticultural department planted an orchard near Shelbyville which is to be used both for experimental and demonstration purposes. Variety tests with peaches, apples, and strawberries were under way on the station grounds during the year. A vineyard has been planted with a number of varieties of grapes, and variety testing with grapes and other small fruits is in progress. Some selection work with tomatoes in greenhouses was also carried on. The experiments of the station in field crops included a continuation of soil-fertility plats to which various fertilizer elements were applied separately and in combination and with or without lime, rotation systems, selection of barley and wheat, and experiments to determine the value of potash.

Tobacco investigations have been carried on for a number of years in cooperation with the Department of Agriculture. Soil surveys of two counties were completed. Cultivation experiments with corn showed that on soils of good physical condition cultivation is not necessary except for the purpose of keeping down weeds. A variety of winter oats has been obtained which withstands winter conditions well.

A beginning was made in the study of forage poisoning in horses. This disease appeared not to be transmissible, but to be due to oat hay contaminated with chicken dung. It is apparently related to the disease attributed to moldy feeds. Pure cultures of molds obtained from the material, however, do not always prove to have a toxic effect. A further study of this disease will be made. In the study of the etiology of hog cholera an antigen was prepared from the mesenteric glands of hogs affected with an acute form of cholera. By this means complement fixation was accomplished. The department of entomology and botany carried on observations on the Kentucky weeds and poisonous plants and published a bulletin dealing with this subject. Studies were also begun on the life history of the greenhouse white fly. A series of selections were continued of clover, timothy, and wheat.

The miscellaneous chemical work of the station involved numerous analyses of soil samples, limestones, the systematic analysis of type soils collected in two counties, and testing of soils for farmers in relation to lime and fertilizer requirements.

The following publications were received from this station during the year: Bulletins 177, Analyses of Commercial Fertilizers; 179, The Construction and Equipment of Dairy Barns; 180, The Inheritance of Coat Colors in Horses; 181, Suggestions Relative to the Prevention of Hog Cholera; 182, Hog Cholera and Its Control; 183, Some Kentucky Weeds and Poisonous Plants; 184, Six Different Species of Nodule Bacteria; 185, Concentrated Commercial Feeding

Stuffs; 186, Experiments with the Sharpless Mechanical Milker; 187, The Life History and Habits of the Corn Earworm (*Chloridea obsoleta*); 188, The Relation of Sulphur to Soil Fertility; 190, The Value of Distillers' Dried Grains in Swine Feeding Operations—The Value of Wheat as a Feed for Swine; and Results of Two Years' Work on London Soil Experiment Field.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	82,959.20
Fees, including balance from previous year	98,676.32
Farm products, including balance from previous year	17,938.72
Misscellaneous, including balance from previous year	46,296.01
Total	275,870.25

The investigational work of the Kentucky station is of wide extent and of high grade. Most of the members of the station staff are largely relieved from college duties and interruptions of other sorts and are thus able to devote their time more exclusively to research work. The esprit de corps of the station is excellent, and the support which the station receives from the people of the State is substantial and encouraging.

LOUISIANA.

No. 1. Sugar Experiment Station, *Audubon Park, New Orleans.*
No. 2. State Experiment Station, *Baton Rouge.*
No. 3. North Louisiana Experiment Station, *Calhoun.*
No. 4. Rice Experiment Station, *Crowley.*

W. R. Dodson, A. B., B. S., *Director, Baton Rouge.*

The continued growth of the stations' activities, taken in connection with the numerous related duties of an administrative nature which have fallen upon the shoulders of the director of the stations, has resulted in a rather serious overburden of work. Possibly some change in organization will be necessary in order to relieve the director of some of his administrative duties and thus give him more time for the supervision of the work of the station. Toward the close of the year Dr. W. E. Cross resigned as research chemist of the sugar station, and his place was filled by the appointment of Dr. M. A. Schneller. Several of the long-standing Adams fund projects were reorganized as a result of natural changes in the direction which the investigation was taking and were considerably strengthened by these modifications.

Adams fund projects.—The old Adams fund project on the non-sugars of sugar cane was reorganized and subdivided into three projects on the investigation of the sulphitation process, molecular

rearrangement of reducing sugars with weak alkali, and influence of red rot on the composition of sugar cane. It has been found that plantation sugar after being made pure white may undergo a color change, becoming darker. An attempt is being made to devise a secondary clarification which will be permanent. The change of color was thought to be on account of an acid reaction of the sugar which later is changed to alkali. Sodium aluminate was used in this secondary clarification, and satisfactory results were obtained from the use of 0.01 per cent of sodium aluminate. This treatment did not give as satisfactory results with sirup and molasses. The sugar plantations of Louisiana are going more and more into the business of making white sugar, and this investigation is therefore considered of fundamental importance to the industry. An attempt to use waste molasses as material for making various organic acids showed that this process is impractical.

The investigation of the bacteriology of sugar and sugarhouse products was carried on under three projects on the bacterial flora of sugarhouse projects other than sugar, the microorganisms which affect the sugar content of borer-infested cane, and the bacterial deterioration of cane sugars. In the disinfection of cane-sugar factories the best results were obtained from the use of formaldehyde. For cleaning tanks containing fermented juices it was found that either chlorid of lime or milk of lime might be substituted for the formaldehyde at a reduction in cost. All disinfectants used in this work gave more satisfactory results when applied hot.

In the study of sugar deterioration under the influence of bacteria a series of sugars from different localities are maintained both at room temperature and also in an incubator at 34°. This study involves the determination of the influence of moisture, the type of sugar, and the degree of infection on the types of organism present. An investigation is also being made of the effect of drying sugar on the microorganisms contained in it. The effect upon the organism is believed to be due to a change in osmotic pressure as a result of drying. In connection with a study of the fermentation of cane due to organisms carried into the cane by cane borers the cooperation of a chemist has been secured.

Work on the cotton-wilt project was interfered with during the year by a series of accidents. In connection with the study of tomato wilt a careful investigation is being made of infected soils and of the life history of the organism which causes the disease. A resistant strain of tomatoes has been developed, but this strain lacks quality and earliness. Some seed of this strain has been distributed for testing in different parts of the State. More confidence is felt in the possibility of producing a resistant strain by hybridization. The life history of the organism of eggplant wilt has been largely

determined. The fungus attacks the leaves, stem, and fruit, and appears to be carried over from season to season on the seed and also on parts of the old plants in the field. Apparently the best method of control consists in securing healthy seed.

The project on alfalfa diseases made only moderate progress during the year. An effort is being put forth to secure a kind of alfalfa which will be resistant to the trouble. Thus far little success has attended these efforts. Some progress was made on the disease of sugar cane, particularly the red rot. This disease, while apparently associated with other fungus troubles and physiological disturbances, is considered to be individually important, as no method has yet been found for controlling its development. Continued work on the cotton rots also yielded negative results in so far as securing resistant strains was concerned. In the study of bean anthracnose it was found that the fungus did not tolerate even a moderately high temperature. This appears to account for the disappearance of the disease during the summer months. The disease is apparently reintroduced by infected seed. The critical temperature of the fungus of bean anthracnose is 29° to 31° C. Only slight progress was made in the study of rice smut and wilt disease of peppers.

In the investigation of the nature and causes of cottonseed-meal poisoning a test was made of the effect of copperas as a safeguard when using this feed. In the first experiment along this line the cottonseed meal proved to be nontoxic, and the results were therefore of little value. Incidentally it was found that the use of 2 pounds of copperas in a barrel of water of which each 100-pound pig was allowed to receive one-half gallon had no bad effect on the pigs. In further experiments hogs were allowed to eat all the cottonseed meal they would, together with corn chops, for a period of 33 days without showing any injurious effects. No harm resulted from the use of decayed cotton seed. The results thus far obtained confirm the belief that the toxicity of cottonseed meal may be destroyed by higher temperatures. In the further prosecution of this project a definite effort will be made to standardize the toxicity of all samples of meal which are used in the experiment.

In continuing the project on the means by which anthrax is disseminated attention was given particularly to the possible agency of the horn fly in transmitting this disease. In these experiments guinea pigs and rabbits were used. It was found that if horn flies suck the blood of diseased animals just at the point of death these flies may be able to transmit the disease. Apparently the anthrax organism is not sufficiently abundant in the blood to cause such transmission even a few hours before death. Incidentally in connection with this work an organism was found which appears to be decidedly antagonistic to the development of anthrax.

The time and energy of the entomologist were so largely occupied with work in connection with nursery inspection and citrus canker that little progress was made on his project relating to rice insects and the southern corn rootworm.

The project on heat transmission and entrainment in vacuum evaporation apparatus was reorganized and subdivided into two projects representing the two main lines of inquiry, namely, evaporation in sugar manufacture and an investigation of bagasse furnaces. During the year the station published a bulletin giving an account of the numerous experiments thus far carried on at the station in connection with the investigation of evaporating apparatus in sugar houses. In the study of bagasse furnaces much work was done on three types of these furnaces. The efficiency of the furnaces was measured by gas used, the amount of water transformed into steam, and the temperature of the gases in the stack. An analysis of samples of flue gases failed to give concordant results, and further work will be done with particular reference to the completeness of combustion.

Work with Hatch and other funds.—At Audubon Park numerous fertilizer experiments were carried on in the field with sugar cane, and the propagation of seedling canes was continued. In cooperation with this department a study was carried on with various cane insects and the Argentine ant. The growing of clover to be plowed under at a certain stage in the development of sugar cane is also under experiment. At Baton Rouge a large variety of general experiments were under way. Sudan grass was found to produce large yields but did not develop seed. Tests were also made of hogging down corn, the use of cowpeas and sweet potatoes for hogs, and making silage of Japanese cane. This cane produced 24 tons of silage per acre. In connection with some rotation experiments corn and soy beans were used for silage with satisfactory results. The miscellaneous experiments at Baton Rouge also included growing alfalfa with and without stable manure, a comparison of fertilizers and green-manure crops for corn, and feeding experiments with steers and hogs.

The dairy work included a comparison of two kinds of milking machines, feeding experiments with dairy cows in which comparison was made between oat pasturage and silage, and miscellaneous feeding tests.

A study is being made of the lime and phosphorus content of certain of the soil types in the State in connection with the survey work of the Bureau of Soils. Numerous cooperative fertilizer experiments were also under way.

The horticultural work included an effort to secure a better quality of seed of bell peppers, experiments in pickling peppers, and an investigation of methods of handling and shipping peppers so as to get

them to market in more satisfactory condition. A wide interest has developed in cauliflower growing, and an association has been formed which now ships this vegetable in carload lots. The station showed by experiment that it is not necessary to transplant cauliflower, and the horticultural department has been following the practical study of this crop very closely. An attempt is being made to develop a late variety. It was shown that inferior lots of cauliflower may be satisfactorily shipped in brine for pickling purposes.

The work of the Rice substation at Crowley was carried on without change in plan from that of last year. Some delay was necessitated in the milling experiments by difficulties in obtaining the kind of mill which was desired.

At Calhoun the work involved mainly a series of tests and demonstration experiments regarding farm practices connected with cattle, field crops, and fruits. An attempt is being made to secure data on the cost of maintaining cattle and on the commercial possibilities of grapes.

The following publications were received from this station during the year: Bulletins 146, Bacteriological Investigations of Sugar-cane Products; 147, Paille Finne Grass; 149, Performance Tests of Sugar-house Heating and Evaporating Apparatus; 150, Citrus Canker; 151, Cattle Feeding on the Plantation and Farm; 152, Anthrax or Charbon—Points of Popular Interest; 153, The Comparative Value of Various Germicides for Use in Cane-sugar Factories; Crop Pest Notices 1, Notice Relating to Citrus Canker; 2, Phylloxera Galls Affecting Pecan Trees; 3, Entomology, or the Study of Insects, and Its Importance; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	24,291.70
Fees, including balance from previous year	20,915.58
Farm products	5,910.48
Total	81,117.76

The Louisiana stations are covering a wide field of investigation and experiment and are doing much work of practical importance. The projects under the Adams fund are especially noteworthy for their grade and effectiveness. The scope of the activities of the station and their distribution over the State are such that they might profitably occupy the entire attention of a director.

MAINE.

Maine Agricultural Experiment Station, *Orono.*

C. D. Woods, Sc. D., *Director.*

The work of the Maine station as a whole continued without essential change of policy or members of the staff. As in previous years, several specialists from other institutions were connected with the station during the summer season, carrying on investigations particularly in the field of entomology. The State legislature appropriated $5,000 for the support of investigation at the Aroostook farm. Other funds were needed to supplement the work at that farm, and these funds were furnished by private contributions. The barns at Highmoor farm were refitted, adapting them better for sheep. E. J. Theriault was appointed assistant chemist, and C. H. White and W. E. Curtis as scientific aids.

Adams fund work.—The three projects of the biological department on analysis of cellular structure of hybrids, normal growth and post-embryonic differentiation, and experimental modification of the hereditary process were continued actively, and a large mass of data was accumulated on many phases of breeding, reproduction, and inheritance in plants and animals. Some of this work was published in bulletins and in scientific journals. The results of 17 years' work in poultry breeding are being prepared for publication. This will practically close the phase of the breeding work, which has been concerned with the improvement of poultry by selection. Especial attention was given during the year to studies of inheritance of body and size of egg and color, with white-egg and brown-egg breeds. These studies involved measurements of 15,000 eggs. Black Hamburg and Plymouth Rock crosses were subjected to fumes of ether and alcohol to determine whether these fumes would produce any poisonous effect which was hereditary.

In an investigation of oat breeding it was found that the Victor oat and the Imported Scotch oat were far less variable than the other varieties in the experiment. This was taken as indicating that these varieties are less affected by seasonal differences than others. It appears that a variety which will yield highly under favorable conditions, but poorly under unfavorable ones, is not so desirable as a variety which will yield moderately well under any conditions likely to be met in a season of growth. In selecting oats within pure lines, 28 pure lines representing 13 varieties were grown in 621 rows involving more than 12,500 plants. The characters under study in this work were weight of grain, weight of plants and of straw, height of plant, and number of culms. It was found that as a rule there is an excess deviation in the direction of the selection in the year following the selection. This apparent effect is much less noticeable or

not at all evident in later years and appears to be due to physiological rather than genetic causes. With respect to the oat characters which were under study, selection for three years produced no effect which could be detected.

In studying variation in corn, measurements were made at twice-a-week intervals of the height of three series of corn plants. The absolute variability showed a marked increase up to about June 19. It appears that the corn plant grows in a series of cycles and that each cycle is characterized by the special development of one set of organs. The observed differences in the manner of growth of individual plants can not be explained as the effect of external environmental factors.

Observations on plumage patterns in fowls indicated that the precise pattern exhibited by a particular feather is reproduced each time the feather is produced by the same follicle, with extreme fidelity of detail. Broodiness in the domestic fowl was found not to be connected with any particular season but rather with the functional activity of the ovary. A study was made of the histological basis of shank colors in domestic fowls. Yellow of various shades appears to be due to the presence of licochrome pigment. Blue color develops when a melanin pigment lies in the upper part of the dermis proper.

The evidence obtained from the study of a case of cystic degeneration of the ovaries of a cow indicated that the corpus luteum, through its internal secretion, exercises the function of maintaining in full development the secondary sex characters. The investigations of the biological projects also included some preliminary studies of inheritance in beans, of reciprocal hybridization in poultry, and continuation of the study of inbreeding in cattle and the relation of body conformation in cattle to milk and fat production.

In the project on the life history of aphids attention was given particularly to the potato aphis (*Macrosiphum solanifolii*) and *Rhopalosiphum nymphæ* as a plum pest. The potato aphis was shown to have alternate hosts and to migrate from the potato to the rose, where the insect passes the winter. Careful records were made of the various phases in the life history of other aphids which live upon members of the rose family. This study of the habits and host plants of aphids is considered as being fundamentally important in devising rational methods for controlling these pests. As a preliminary phase of the ecological study of Jassidæ and Cercopidæ, the representatives of these two families of insects in Maine were carefully studied from a systematic standpoint, and descriptions were drawn for a number of new species. A large number of observations have also been recorded on the life history and habits of these forms.

In connection with the study of economic Diptera it was found that the apple maggot naturally breeds in abundance in the blue-

berry and that under such circumstances it is attacked by a parasite which promises to be of some economic importance. Initial experiments with poisoned bait for the destruction of the apple maggot gave results which warranted the further test of this method on a large scale. It was found that orchards sprayed with poisoned baits were comparatively free from attacks of apple maggot. The study of economic species of Hymenoptera was largely confined to work on the immature stages of sawflies. Careful records were made of the eggs and larvæ of a number of species of this group of insects.

Powdery scab of potatoes received much attention with reference to the distribution of the disease which persisted in soil and the methods for controlling it. The disease appears to persist in the soil for three years or more. An effort was made to devise some method of growing the organism of powdery scab in pure cultures in order to be in position to study its life history in the soil. This effort has thus far not resulted in much success. Observations were made on the effect of various temperatures upon the fungus. No definite evidence has thus far been obtained of how the disease spreads from seed to crop or of the form in which it persists in the soil. In a case of ordinary potato scab exposure of seed potatoes to direct sunlight was found to be an effective means of preventing the scab. No scab developed in soil which had been sterilized by steam unless the seed potatoes were scabby, in which case 30 per cent of the crop showed scab. Under the same conditions the use of 300 pounds of sulphur per acre insured a clean crop.

The Rhizoctonia disease of potatoes received much attention. In pot experiments the soil was inoculated by burying small sclerotia of the fungus threads immediately beneath each potato tuber. In this test the fungus did not seriously attack the young plants. When, however, young tubers on plants in pots were inoculated with pure cultures, all plants developed cases of Rhizoctonia disease similar to that observed in the field. Treatment of the tubers with corrosive sublimate appears to be the most effective means of preventing the development of the disease. It was shown that the fungus persists in the soil for several years without the presence of a crop of potatoes. The fungus appears to grow either as a saprophyte or as a parasite upon a wide range of hosts.

Considerable progress was made in the study of potato wilt, which appears to be a fungus disease carried by the potato tubers. It is still uncertain whether the disease in Maine is identical with the disease of the same name in the Western States. The mosaic disease proved to be more common on Green Mountain than on Irish Cobbler potatoes. The cause is as yet unknown. Potato leaf-roll has only recently appeared in the United States, and it is still uncertain whether a disease which resembles it in Maine is identical with the European

form of the disease. Some attention was also given to the so-called spindling-sprout disease of potatoes.

Work with Hatch and other funds.—As in previous years, nearly all the work of the Maine station has been organized under definite Adams fund projects, and the Hatch and other funds have been for the most part used to supplement the Adams fund. However, an increasing amount of work is being done at the Aroostook farm and in cooperative experiments. In some orchard-spraying experiments carried on during the year at Highmoor farm arsenate of lead used alone, as in previous years, gave quite satisfactory results as a fungicide for preventing apple scab. If these results are confirmed it will make possible a recommendation which will materially reduce the expense of spraying without diminishing its efficiency. Incidentally it was learned that the application of Bordeaux mixture to Ben Davis apple trees just before the blossom buds opened caused a marked increase in the russeting of the fruit. No satisfactory explanation for this result has been offered. Bordeaux mixture proved to be the most efficient remedy for the control of scab, but caused more russeting of the fruit than any of the other remedies which were compared. In these experiments soluble sulphur, atomic sulphur, and arsenate of lead were used in comparison with Bordeaux mixture.

Among the general field experiments carried on by the station were a test of commercial varieties of oats at Highmoor farm, a test of new varieties of oats originated at the Highmoor farm, a test of different rates of seeding oats in Aroostook County, fertilizer tests with potatoes and apples, and experiments to determine the value of turnips as a stock food. It was found that relatively high rates of seeding oats gave the largest yields. Larger yields of potatoes were obtained from the use of ammonium sulphate than from sodium nitrate. Somewhat larger yields of potatoes were obtained when the fertilizer was applied in the drill than when applied by other methods. It is planned to carry on experiments with buckwheat and grasses at the Aroostook farm in order to determine the importance of these crops in rational farm management.

The following publications were received from this station during the year: Bulletins 228, Factors Influencing the Size, Shape, and Physical Constitution of the Egg of the Domestic Fowl; 229, Studies on Oat Breeding, I; 230, The Rhizoctonia Disease of Potatoes; 231, Improving Egg Production by Breeding; 232, The Histological Basis of the Different Shank Colors in the Domestic Fowl; 233, Maine Aphids of the Rose Family; 234, Finances, Meteorology, Index, Abstracts of Papers Published by the Station in 1914 but not Included in the Bulletins; 235, Studies on Oat Breeding, II; 236, Field Experiments in 1914; 237, The Assumption of Male Secondary Characters by a Cow with Cystic Degeneration of the Ovaries; 238, Leaf-

hoppers of Maine; 240, Apple Spraying Experiments in 1914; Official Inspections—57, Ice Cream; 58, Butter; 59, Molasses; 60, Analyses of Feeding Stuffs; 61, Drugs; 62, Fertilizer Inspection; 63, Ice Cream; 64, Seed Inspection; 65, Miscellaneous Food Materials; 66, Opened Shellfish; and 67, Milk and Cream.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	14,500.00
Fees	12,288.75
Farm products	16,450.31
Total	73,239.06

The work of the Maine station is largely of a research nature. The investigations thus far carried on have made valuable contributions to the knowledge of the principles of heredity of plants and animals and to an understanding of the life history of insects and fungus diseases. With the acquisition of Aroostook farm and Highmoor farm it is possible for the station to test out these scientific findings on a larger scale and also incidentally to bring the work of the station more prominently before the farmers of the State.

MARYLAND.

Maryland Agricultural Experiment Station, *College Park.*

H. J. Patterson, B. S., *Director.*

The work of the station was continued along the same lines as during the past year with the exception of the Adams fund work of the dairy department, which was interrupted on account of resignations from the station staff. Director Patterson of the station was also president of the college during the year. C. E. Temple was appointed associate plant pathologist, and R. C. Rose associate botanist. The State appropriation to the station for the year was about $14,000, of which $4,000 was designated for use in horticultural studies and $10,000 for the general work of the station. No new station buildings were erected.

Adams fund projects.—Progress was made in the study of the life history of certain dipterous leaf miners. The work was confined largely to the leaf miner of Aquilegia, of *Chenopodium album,* and of boxwood, particularly the first two. The Aquilegia miner has been identified as *Phytomyza aquilegiæ,* and the miner of *C. album* as *Pegomyia hyoscyami.* The only occurrence of the boxwood miner in Maryland was in Baltimore. The preliminary experiments indicated that this pest could be controlled by spraying with molasses, in which the delicate adults are captured.

About 10 acres of land have been devoted to the cultivation of the peach in the study of hardiness. The trees are now 2 years old and are chiefly of three varieties—Gainsborough, Elberta, and Late Crawford. In this work the moisture will be kept under control as far as possible by means of drainage arrangements, in order to determine the effect of varying moisture content in the soil on fall maturing of the wood and on winter hardiness. This study will also involve the use of dwarf varieties of peaches in large containers.

In the investigation of fruit-rotting Sclerotinias, efforts were chiefly directed to the investigation of the effect of external conditions on the development of the apothecia of *Sclerotinia fructigena*. This involves the use of various chemicals, particularly amygdalin, glucose, and benzaldehyde. Since amygdalin was found in the pits of the plum and peach it was thought that the development of apothecia might be influenced by the decomposition of the products of amygdalin. No apothecia were obtained. Thus far it has been impossible to produce infection artificially except in one or two instances, and the common method of natural infection is still unknown.

The relation of sulphur and sulphur compounds to cell structure was studied during the winter in pots containing ordinary soil and maintained in the greenhouse. Sulphur was applied in three forms, as flowers of sulphur, ground sulphur, and carbon bisulphid, in amounts varying from one-half to 10 per cent. Even the smallest amounts check the growth of plants and cause them to turn yellow. It is proposed in a further study of this problem to use balanced solutions in sand instead of soil and to confine the experiments to tomatoes and corn.

Thus far no winter stage of the organism of tomato blight has been found. An attempt is being made to learn how the disease passes the winter. All tomato stems, leaves, and fruits are being carefully examined for this purpose. No difference in resisting power has been observed in the different varieties of tomatoes. The fungus appears to develop more rapidly in hot weather. Apparently flea beetles are not important agents in the spread of the disease.

The long-standing project on the effect of fertilizer constituents in mutation in plants was continued during the year. The work involved chiefly the application of excessive amounts of common fertilizer constituents to vegetables to determine whether any effect was to be observed in the progeny, particularly in production of mutation. The experimental plants were chiefly tomatoes, wax beans, and cowpeas. Certain specific effects have been observed which are apparently hereditary, at least through two or three generations.

The continued study of the metabolic changes in potato tubers brought out some interesting results. A considerable difference in respiratory activity of different varieties of potatoes was noted. The

evidence thus far obtained appears to show that the oxidase content in potato juice gives no indication of the rate of respiration in potatoes. Oxidases are apparently not controlling factors in respiration. Catalase activity, however, was found to be closely correlated with respiration. In this work it appeared that potatoes will not sprout normally when the total sugar content of the tuber is more than 0.2 per cent. It was found that even under favorable conditions the potato tuber holds its moisture most tenaciously and that the sprout is unable to secure sufficient water for growth if there is a high sugar content in the tuber. Further work will be required before the complete scientific explanation of little-sprout disease in potatoes is ready for publication.

In a study of the rate at which lime is diffused in the soil the work during the year consisted largely in the determination of chlorin, sulphur, magnesium, and nitrogen in the drainage water. This work is all carried on in pots of soil. Particular attention is given to the diffusion of acid radicals in the drainage water as related to the lime requirements in the soil. It appears that sulphate radicals remove salts from the soil most rapidly, while chlorid radicals come next in order, followed by nitrates and carbonates. The projects on bovometric relations in dairy animals and problems relating to city milk supplies were practically in abeyance during the year on account of the resignations of the men who had previously been leaders in the work of these projects.

Work with Hatch and other funds.—Experiments with poultry included tests in the incubation of the eggs to determine how soon the eggs become fertile after the fowls are mated, a test of several thousand eggs in incubation to learn how long eggs may safely be kept before being incubated, a comparative test of shelters for chicks on hot days, and a rather elaborate study of practical rations for laying fowls. The breeds used in the feeding experiment were White Leghorns and White Plymouth Rocks. Particular attention was given to a comparison of different forms of protein in the ration, including cottonseed meal, soy beans, gluten feed, and beef scrap. Egg production was considerably greater in the lot of hens which received a mixture of various proteins than in any of the lots receiving only one protein. In the incubation test it was found that eggs kept more than 10 days before incubation showed a low hatching percentage.

In addition to the Adams fund project on leaf miners the entomological department carried on some work in the control of woolly apple aphis under nursery conditions. In cooperation with the Bureau of Entomology of the Department of Agriculture, an experiment is under way for the purpose of devising a method of controlling housefly maggots in manure. Manure directly from the stable is placed on a rack above a water vat and is sprayed with water. The maggots fall

in the water and are drowned. Evidence thus far obtained indicates that this is rather an effective method of controlling fly maggots.

In the field of horticulture the station conducted a large number of general experiments. Phenological records were kept on 70 varieties of peaches, 70 varieties of plums, and 20 varieties of cherries on the station grounds and at various points throughout the State. It appears that there is some advantage in late blooming from the standpoint of yield. Pear-breeding experiments have been carried on since 1905, and several trees developed in this work came into bearing during the year. About 100 apple seedlings fruited, and three or four of these appeared to be promising from a commercial standpoint.

Further hybridization work will be carried on with apples and pears. Several seedling hybrid grapes developed at the station came into bearing during the year. Some work was also done in grafting vinifera grapes on hardy stocks. In experiments with fertilizers and mulching on strawberries the results indicated heavier yields from the use of mulch than from fertilizers. Some experiments in selecting potato seed from low and high yielding hills showed that the yielding capacity was apparently not hereditary. A strain of cabbage was obtained which proved to be quite resistant to yellows, but not resistant to stem rot.

The agronomy department devoted much time to experiments with soy beans for hay and seed. A few strains have been secured which seem to be fairly well fixed. Sudan grass has been under observation at the station for four years. A test is being made with this grass in which one and two cuttings are compared, as well as broadcasting, sowing, drilling, and wide and narrow rows. Extensive experiments were also begun with green-manure crops and with methods of selection and crossing for fixing desirable characters in cowpeas and wheat.

The chemical department of the station made a comparative study of the agricultural value of limestone ground to various degrees of fineness. An attempt is being made to determine the solubility of lime under different degrees of fineness and at four temperatures. The highest lime requirement found in Maryland soils is 4,000 pounds per acre, and an application of that amount appears to be good for 11 years. Results thus far obtained indicate that the finer the lime the better the results from an agricultural standpoint.

The following publications were received from this station during the year: Bulletins 180, Tomatoes—Varieties, Diseases, Culture; 181, Inexpensive Aids in Producing Sanitary Milk; 182, Experiments with Small Fruits; 183, Biochemical and Physiological Study of the Rest Period in the Tubers of *Solanum tuberosum;* 184, The Physical Character of the Curd of Milk From Different Breeds—

Curd as an Index of the Food Value of Milk—Studies of the Proteid Content of Milk; 185, The Maryland Hog—Statistics—Housing—Feeding—Care and Management—Miscellaneous Information—Breeds and Breeding—Diseases of Swine; 186, Land Drainage in Maryland; 187, Profitable and Unprofitable Cows—Cow Testing Associations in Maryland; 188, Types and Varieties of Maryland Tobacco; 189, Grass and Rape Seed Inspected in 1913; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	9,500.00
Farm products, including balance from previous year	10,236.56
Miscellaneous, including balance from previous year	2,393.19
Total	52,129.75

The Maryland station continues to occupy an important place in relation to the agriculture of the State. Farmers' day at the station was more largely attended than ever before, and evidence was obtained from other sources that the station is coming into closer touch with the farmers and is doing work which can be applied in the improvement of practical agriculture. The combination of the offices of president and director is not regarded as advantageous to the station, and is not in harmony with the recent trend of organization.

MASSACHUSETTS.

Massachusetts Agricultural Experiment Station, *Amherst.*

W. P. Brooks, Ph. D., *Director.*

Conditions and progress during the year at the Massachusetts station were satisfactory. The general status and policy of the institution were not changed. The State appropriation to the station was increased to $25,000. Several additions were made to the station staff, chiefly for work on Adams fund projects. these appointments included G. E. Gage, Beryl H. Paige, and A. P. Sturtevant, in animal pathology; H. D. Goodale and R. P. Armstrong, vice J. B. Norton, in biology; and C. L. Beals as assistant chemist, vice R. W. Ruprecht. The work of the station was thus materially strengthened, especially as regards the Adams fund projects. A private estate at Stockbridge, in the western portion of the State, was offered to the station for use, and plans have been made for carrying on experiments on a portion of the estate during the coming year.

Adams fund projects.—In continuing the project on the chemistry of the asparagus plant, including the problem of nitrate assimilation,

a large number of samples were taken of asparagus roots and shoots, and analyses were made for the purpose of determining whether any relationship exists between the composition of the plants and the fertilizers which the plants received. Particular attention was given to the translocation of the plant food at different seasons from the root into the shoot and from the shoot back to the root. Thus far no definite correlations have been established. It is planned to supplement the work with pot experiments carried on at the central station.

The project on principles underlying the use of fertilizers for the cranberry crop was carried on actively. As in the previous year, it was found that the setting of blossoms was stimulated and increased to a considerable extent by the application of nitrogenous fertilizers at the beginning of the blooming period. It appears that a distinct increase in the quantity of fruit was brought about and that this was not due so much to an increase in the size of the berries as in the number of berries on each plant.

The project on the chemistry of butter fat was reorganized, and work was directed largely to a study of the effect of fat in modifying the chemical and physical characteristics of butter fat. It was found necessary to improve the precision of methods by further investigation. In this work it appeared that the acetyl numbers of the fats and insoluble acids afford valuable information on the nature and quality of the product. The determination of the acetyl numbers was found to be a comparatively short and simple process, and the results proved to be directly comparable with the determination of other physical constants for fats.

The solubility effect of ammonium sulphate on the soil was studied with reference to the chemical interactions which take place between ammonium sulphate and other soil constituents. It was found that either aluminum or iron sulphate in relatively small quantities in solution exercises a toxic effect upon clover. This is considered one of the principal reasons for the failure of clover following the use of sulphate of ammonia as fertilizer, since both the aluminum and iron of the soil are to some extent rendered soluble by the action of ammonium sulphate. Aluminum sulphate, however, when present in culture solutions in concentrations greater than 40 parts per million, showed a decidedly toxic effect on clover seedlings. Toxic effects were also produced by ferrous sulphate when present in concentrations of four parts per million. The injurious effect of iron and aluminum in solution was largely overcome by the use of calcium carbonate. Calcium sulphate, however, did not have the same beneficial effect. Calcium in the form of carbonate was found to precipitate the iron and aluminum in the form of hydroxids.

The study of the comparative effect of sulphate and muriate of potash on soils was continued. This work was carried on in connection with the use of bone meal. It appears that the muriate of potash produces a growth more resistant to cold or possessed of a superior degree of hardiness. This was found to be the case particularly with raspberry, in which a tendency to resist winterkilling was noted after the use of muriate of potash. Similar effects were produced upon squash. In studying the effect of lime absorption upon the acidity of the soil and the growth of clover a great increase in the size of the clover plants and in their content of nitrogen was shown in all cases where lime had been added in combination with sulphate of ammonia. The indications are that these effects are due to the action of the lime on the properties of the soil rather than to its action within the plant itself. It is suggested that the beneficial action of lime upon bacterial growth is also concerned in the result. The availability of nitrogen on the unlimed halves of the plats treated with sulphate of ammonia was much less than on the limed halves, and this is believed to be partly due also to the presence of sulphate of iron and aluminum in the soils.

In the study of the conditions under which arsenicals burn foliage it appeared that most of the burning is due to impurities in the insecticides. During this work about 6,000 tests were made on the different plants under a variety of conditions and supplemented by numerous chemical analyses. The investigation of the economic importance of the digger wasps in relation to agriculture was continued. Much work was done in studying the life histories of several species of these wasps. Decided progress was made in the investigation of cranberry insects, particularly the cranberry fruit worm. Much attention was given to a parasite (*Trichogramma minuta*) which is known to be parasitic on the eggs of nearly 50 species of insects. This parasite was found to destroy about 56 per cent of the cranberry fruit worm eggs on dry bogs near the cranberry substation. It is proposed to study the problem of increasing the natural effectiveness of this and other parasites. Attention was also given to the flowed bog fireworm, the cranberry tip worm, gipsy moth, cranberry weevil, and other insect pests of the cranberry.

Some progress was made in the study of inheritance of color in garden peas and of variation in apples. In the case of peas and beans attention was given to the weight of seed, length of vine, and other characters, and an effort was made to isolate pure strains of squashes by self-fertilization. The study of variation of apples under different conditions of environment, such as slope, elevation, etc., was continued in nine localities in different parts of the State. It appeared that in the case of Ben Davis apples the fruits from the south

quarters of the trees are larger than those from other parts. A rather constant relationship was found between the form of the apple and the temperature of the period following blooming. The cooler the temperature at this period the more elongated was the apple. Interrelation of stock and scion in apples received much attention in an orchard in which 3,000 trees are now established on known roots. A large mass of data has been accumulated on this work, but it has not yet been digested.

Some progress was also made in the study of the influence of electrical stimulation of nitrogen fixation. A comparison was made between the effects of direct current, alternating current, and static electricity when used for this purpose. The results are not ready for publication.

The study of broodiness in poultry was greatly interfered with by the unusual prevalence of white diarrhea. Some observations, however, were recorded on strains of Rhode Island Red fowls. The investigation of bacillary white diarrhea in poultry was continued actively. The agglutination test for detecting individual hens which are carriers of the disease was further studied, and the method was greatly perfected in a number of important details. It appears now to be well demonstrated that the method is useful in preventing white diarrhea among chickens when the precaution is taken to incubate eggs only from hens which successfully pass the test. The agglutination test is relatively inexpensive and may be generally applied by poultrymen.

In continuing the study of mosaic disease in tobacco the morphology and histology of healthy tobacco plants were compared with those plants affected with the mosaic disease. Attention was also given to enzyms in healthy and diseased plants and to the effect of the color and the intensity of light on the disease. Some experiments were also begun in studying the effect of oxidizing substances when applied to the soil and in determining the effect of radio-active substances.

Work with Hatch and other funds.—In agronomy a large variety of experiments was carried on. Alfalfa was found to be superior to alsike clover in yield and palatability. It was found necessary to apply 1½ to 2½ tons of lime for the best growth of alfalfa. The Grimm variety of alfalfa appears to be superior for Massachusetts conditions, and the best results were obtained from sulphate of potash and phosphoric acid in basic slag meal. As a result of experiments extending over a period of 25 years and confirmed by further experiments during the year, it appears that in Massachusetts potash rather than phosphoric acid is ordinarily the most important mineral food requirement for plant growth. The conclusion has also been reached that dissolved phosphates are preferable to finely ground rock phos-

phates. Considerable attention was also given to economic studies on the cost of production of tobacco, onions, and potatoes, on the local balance of trade in farm products, and on agricultural insurance.

The chemical department in addition to its work in cooperation with other departments made a great number of analyses of cottonseed meal and hulls, cocoa shells, proprietary feeds, coconut meal, and fertilizer materials, and also carried on an investigation of the digestibility of cattle foods. It has been found that the quality of cottonseed meal sold in Massachusetts is gradually growing poorer, due partly to the addition of increasing quantities of cottonseed hulls. The study of cocoa shells shows that they have a feeding value equal to about one-half that of corn meal. An extensive series of tables was published, showing the relative digestibility of a great variety of cattle feeds. The coconut meal was found to contain about 100 pounds less digestible matter in the ton than gluten feed. Coconut meal, however, appears to be equal to gluten feed in nutritive value.

The horticultural department carried on experiments in the use of shade cloth for the protection of cranberries from frost in bogs where water for flowage is not available. The use of the shade cloth was found to insure a temperature about 4° higher than the normal temperature without protection. Considerable attention has been given to a suitable system for the technical description of apples, and a plan of action believed to be useful for this purpose was published in bulletin form.

The department of vegetable pathology carried on extensive spraying experiments with cranberries in cooperation with the Department of Agriculture. The results were inconclusive. A study of electrical injuries to trees showed that the strength of current necessary to kill the plant is quite variable. Outside of the disfiguration to trees from pruning necessitated by electric wires, the greatest injury apparently consists of the local burning and partial destruction of the tree by high-tension line wires. There appears to be little or no leakage from wires during dry weather. No authentic cases were observed of trees killed by alternating or direct currents as ordinarily applied. It is believed that the high resistance offered by trees and plants in general serves as a protection against severe injury from lightning and contact from high-tension line wires.

In addition to its investigations carried on under the support of the Adams fund the entomological department investigated a number of problems connected with injurious insects. Particular attention is given to the marguerite fly (*Phytomyza chrysanthemi*). This pest has a wide distribution and attacks a great variety of plants. The life history of the insect was rather carefully worked out. It

appears that the test may best be controlled by spraying with some of the tobacco solutions diluted 400 to 450 times in water and applied at intervals of 11 or 12 days.

The following publications were received from this station during the year: Bulletins 148, On the Diagnosis of Infection with *Bacterium pullorum* in the Domestic Fowl; 149, A Study of Variation in Apples; 150, Reports on Experimental Work in Connection with Cranberries; 151, The Determination of Acetyl Number; 152, The Digestibility of Cattle Foods; 153, A Summary of Meteorological Records for 25 Years—1889 to 1913, inclusive; 154, Alfalfa; 155, New Fertilizer Materials and By-products; 156, Electrical Injuries to Trees; 157, The Marguerite Fly or Chrysanthemum Leaf Miner; 158, The Composition, Digestibility, and Feeding Value of Molassine Meal, Cotton-seed Meal, and Hulls, Cocoa Shells, Grain Screenings, Flax Shives, Mellen's Feed Refuse, and Postum Cereal Residue (CXX Feed); 159, The Technical Description of Apples; 160, Report of Cranberry Substation for 1914; 161, The Effect on a Crop of Clover of Liming the Soil—Toxic Effect of Iron and Aluminum Salts on Clover Seedlings; Meteorological Bulletins 306–317; Control Series Bulletins 1, Inspection of Commercial Feed Stuffs; 2, Inspection of Commercial Fertilizers; Circulars 36, Poultry Manures: Their Treatment and Use; 37, Green Manuring and Cover Crops; 38, Cabbage, Cauliflower, Turnip, Rape, and Other Crucifers; 39, Lime and Sulphur Solutions; 40, Downy Mildew of Cucumbers (*Peronoplasmopara cubensis*); 41, The Control of Onion Smut; 42, Fertilizers for Potatoes; 43, Cutworms; 44, Suggestions for Judging the Agricultural Value and Adaptation of Land; 45, The Chemical Analysis of Soils; 46, Directions for Sending Fruits for Identification; 47, The Feeding Value of Apple Pomace; 48, Beet Residues for Farm Stock; 49, Cabbage, Cauliflower, Turnip, Rape, and Other Crucifers; 50, Rations for Dairy Stock; 51, Downy Mildew of Cucumbers; 52, The Control of Onion Smut; 53, Lime and Sulphur Solutions; 54, Poultry Manures: Their Treatment and Use; and the Annual Report for 1913, pts.1 and 2, and 1914, pt. 1.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	44,797.08
Fees	9,892.00
Farm products	2,377.00
Miscellaneous	13,079.15
Total	100,145.23

The Massachusetts station is investigating with gratifying success a large number of problems which are fundamental to the permanent improvement of agriculture in the State. A more intimate contact

with special agricultural industries has been brought about by the activities of the station in studying the cranberry problems and the production of asparagus.

MICHIGAN.

Experiment Station of Michigan State Agricultural College, *East Lansing.*

R. S. Shaw, B. S. A., *Director.*

No essential change was introduced into the plan of organization or management of the Michigan station during the year. The work of the station was successful and satisfactory. Few changes occurred in the station staff. Dr. L. R. Himmelberger, assistant in bacteriology, resigned. J. O. Linton, assistant poultry husbandman, was succeeded by C. H. Burgess, and G. H. Coons, research assistant in plant pathology, was allowed a furlough during a portion of the year to complete his work for the Ph. D. degree. The State funds available for the station were somewhat inadequate for the plans of work which had been formulated, but with the beginning of the coming year it is expected that they will be sufficient for all purposes.

Adams fund projects.—Satisfactory progress was made in the investigation of soil temperature and the factors which influence it. It was found that temperatures affect the moisture movements in the soil in a peculiar manner. The movement from a warm to a cool portion of the soil increases with the percentage of moisture. The controlling factor is apparently not surface tension alone, but mainly the adsorptive power of the soil. In the study of mulches it was found that the efficiency of mulches depends on temperature. It was shown that the surface temperature was higher under a mulch and that the surface soil, therefore, did not absorb moisture from the cool soil below. An attempt is also being made to correlate the freezing point of soils and the concentration of suluble salts in soil moisture. The physical phenomenon of supercooling has been observed in soils just as in solutions.

The investigation of the organic nitrogenous compounds of peat soils has been carried on continuously for five years. A large part of the work has been done in pots with mixtures of peat and manure. The addition of manure to peat soils causes a pronounced increase in nitrification. A considerable variation in the nitrogen content of peat soils was noted at various depths down to 10 feet. In general, the decomposition of the peat increased toward the lower depths of soil. The total nitrogen increased for the first 4 feet and then decreased for the next 4 feet. It is hoped that a method for determining the availability of peats will be devised.

In the investigation of adsorption in relation to osmosis in soils there is some cooperation between the chemical and soils depart-

ments. The project involves extensive physical investigations. It has been found that there is a decided selective adsorption in cases where the movement of soluble salts is toward a denser solution. This work is being carried on by means of various semipermeable membranes. In continuing the project on adsorption in relation to soluble fertilizer salts the phenomenon of adsorption has been found to be connected with soil acidity. Further studies will be devoted to the effect of adsorption on various factors in soil fertility, particularly with reference to its action on soluble fertilizer salts. Efforts are being made to determine how the elements of these salts are held in the soil, how they become insoluble, and what reactions occur between insoluble soil constituents and added fertilizers.

Encouraging progress was made on the project relating to soil solution and its rôle in the life of microorganisms. In securing the soil solution from soils a cylinder oil has given good results in forcing it out. The oil is quite inert, and about 60 per cent of the soil solution has been recovered for examination by this method. It has the advantage of yielding adequate quantities of soil solution for study. In this work dried blood, tankage, and cottonseed meal have been mixed with the soils and have been allowed to stand for varying lengths of time. An attempt has been made to determine whether the soil solution can be used as a measure of bacterial activity. The tests are made on large samples of soil, approximately 50 pounds each. The technical difficulties have been largely overcome, and the work from now on will be largely a study of the reliability of the composition of the soil solution as a measure of bacterial action.

The study of adsorption of solutes by plants, with special reference to balanced solutions, has been in progress since 1911. Considerable attention has been given to improving the precision of technical methods involved in the study. Distilled water proved not to be a satisfactory solvent. An attempt was made to find a physiological solution suitable for each species of plant involved in the experiment. It appears that monopotassium phosphate, calcium chlorid, and magnesium sulphate in water cultures may be so balanced as to give the best results. The solutions are balanced as nearly as may be, and an attempt is then made to determine the point of concentration at which adsorption takes place at the same rate as excretion.

In the study of apple canker it was found that the disease occurs quite generally in the northern part of the State. Thus far the only practical method of control has been to cut out the diseased areas. The pathogenic organism was isolated and shown to be *Plenodromus fusco-maculans*. This fungus was studied in its relation to environmental factors, and synthetic media were devised for use in making pure cultures of the organism. The fungus affects the young twigs and branches, killing the bark downward in strips.

The veterinary investigations of the station were somewhat interfered with during the year by changes of staff and readjustment between the college and station veterinary work. In the study of hog cholera an attempt was made to determine the effect upon immune bodies of the reaction of the hog to the disease. The relation of various organisms to hog cholera was also investigated, and a special study was made of the antibodies produced by *Bacillus choleræ suis*. It appears that a rather definite relation exists between this organism and hog-cholera virus, since hyperimmunized hogs showed the presence of antibodies to *B. choleræ suis*. The work on contagious abortion developed the fact that as a means of diagnosing the disease the agglutination test and complement fixation test are very satisfactory. All vaccines thus far obtained, however, have given poor and discouraging results. The vaccines apparently had no effect on the morphological elements of the blood.

In investigating the effect of diseases in the cow upon milk the work for the present is confined entirely to the effect of abortion bacillus upon milk and its occurrence in milk. This bacillus has been repeatedly isolated from milk, and agglutination tests with such milk show that it is a safe and reliable means of diagnosing the disease.

Satisfactory progress was also made in the project on the keeping qualities of butter. This study involves an investigation of the common organisms in butter, the tolerance of these organisms for salt, their power of liquefying casein in the presence or absence of salt, and other possible effects of bacteria upon the quality of butter. It appears that there are about 20 species of bacteria commonly found in butter. Some of these grow at a temperature as low as $-5°$ C. Lactic bacteria were found to be the most sensitive to salt. Attention will also be given to the correlation between the bacterial flora of butter and its specific flavor.

Interesting results were obtained in the further study of insecticides with reference to the manner in which they kill. A special study was made of the oxidases, catalases, and reductases in insect tissues and the effect of contact insecticides on these bodies. In this work gasoline, carbon bisulphid, kerosene, and other contact insecticides were used. In every case insecticides affected one or more of the special bodies and destroyed the balance between them. It was demonstrated that the bodies are present in living tissues and that any disturbance in the balance between reductase, catalase, and oxidase interfers with the respiration of the insects. It was found that the presence of gasoline gas renders membranes less permeable to oxygen.

Work with Hatch and other funds.—All the departments of the station carried on work under the support of Hatch and State or other funds. In the soils department some experiments are under

way with lysimeters to determine the loss of lime by leaching. A study is also being made of the nitrogen relation between legumes and a combination of legumes and nonlegumes. This work is carried on in large containers. About 3 acres of muck land have been platted for fertilizer experiments. Plans have also been made to study the possible correlation between physical and chemical properties of soils and their yielding power.

The chemical department is making a study of the causes of the disintegration of cement tiles. In most cases it appears that premature disintegration is due to the use of poor materials, improper mixing, and insufficient curing of the tile. Lime and iron are dissolved out of the tile if it is too porous. Soil acidity has been shown to have no apparent correlation with the percentage of organic matter in the soil. In the case of sandy loam soils it appeared that acidity arises from the formation of soluble salts through the interaction of weak acids and the basic material naturally held in the soil.

The botanical department has studied a number of plant diseases, particularly anthracnose and bacterial blight of beans, a disease of celery known as stunting, and black rot and nematodes on ginseng. It has been shown by experiment that celery soil may be economically sterilized on a commercial scale. In preventing the black rot of ginseng sterilization of the soil with steam or formaldehyde gave satisfactory results. In combating nematodes on ginseng steam sterilization also proved to be the only effective method.

The horticultural work of the station included a wide range of miscellaneous experiments, such as thinning apples and plums, a comparison of water sprouts and bearing wood as scions, a study of the bearing habit of the Northern Spy with reference to certain barren twigs, an investigation of seed inheritance in asparagus, rhubarb, and potato hybrids, a study of variation in the yield of currants and gooseberries, and a comparison of dust and liquid spraying for apple scab. The selection of potatoes from high and low yielding hills showed no effect upon the yield of progeny. It was demonstrated that fresh raspberries might be readily preserved by freezing. In the frozen condition they kept well for six months. Satisfactory methods for cold storage were also worked out for asparagus, squash, and a number of other vegetables.

The experimental work of the animal-husbandry department was largely confined to an attempt to learn the effect of succulent feeds on the production of wool, milk, and meat. Feeding experiments are also carried on with hogs, chiefly to gain information on suitable forage crops. For this purpose feeding lots are used of the size of 8 acres or more.

The general work of the dairy department includes studies in the cost of production of market milk and experiments on the use of the Babcock test and in the manufacture of soft cheese.

The entomological department has been importing fungus diseases and parasites in an attempt to control the larch sawfly, which has become unusually injurious. Incidentally a renewed search is being made for parasites of San José scale and oyster-shell bark louse. Much attention was also given to a study of fruit-tree borer, Hessian fly, and the peculiar unexplained injury to peaches which is possibly due to attacks of the rose chafer. A study of the spreading of lime-sulphur wash on surfaces upon which it was sprayed showed that the extent of spreading was controlled by surface tension and that the surface tension may be lowered by the use of an extraction of Saponaria to the extent that lime sulphur will spread uniformly like an oil spray.

The forestry work of the station is directed chiefly to a study of basket willows and the production of maple sugar. Considerable success has been met in growing basket willows and in securing a market for this product. The work of the station on farm crops was directed chiefly to breeding experiments. In these investigations variety testing is carried on with selections in strips 2 feet wide and several hundred feet long. During the year 40 varieties of wheat were grown in a variety series at the station. Thus far the work gives no basis for hope of improvement of wheat by selection within pure lines. Increased yielding power and strength of straw, however, are apparently hereditary and are easily perpetuated. Varieties of winter barley have been under observation since 1909, and after discarding the less hardy strains two have been retained as having quite superior merits and will be further tested on the Upper Peninsula substation.

The following publications were received from this station during the year: Bulletins 273, Utilization of Muck Lands; 274, Fertilizer Analyses; Special Bulletins 64, Foul Brood; 65, Hog Cholera and Preventive Treatment; 66, The Potato Diseases of Michigan; 69, Spray and Practice Outline for 1914; 71, Studies in the Range of Variation of the Per Cent of Butter Fat in Milk of Individual Cows; Technical Bulletins 18, A Bacterial Disease of the Larvæ of the June Beetle, *Lachnosterna* spp.; 19, Soil Acidity; Circulars 21, Bridge Grafting; 22, The Hog-cholera Situation in Michigan; 23, Sweet Clover; 24, Thinning Apples; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	18,540.00
Fees	6,160.00
Miscellaneous, including balance from previous year	5,030.02
Total	59,730.02

The work of the Upper Peninsula substation serves to bring the investigations of the station prominently before two large constituents of the farming population of the State. The research work of the station is making substantial and satisfactory progress.

MINNESOTA.

Agricultural Experiment Station of the University of Minnesota, *University Farm, St. Paul.*

A. F. Woods, M. A., D. Agr., *Director.*

There were few important changes in the staff or policy of the station during the year. Preliminary arrangements were made for the further perfection of the organization of station work. K. F. Warner, of the animal-husbandry section, resigned, and Dr. L. D. H. Weld, of the division of research in agricultural economics, was succeeded by Dr. E. D. Durand. H. R. Smith, head of the section of animal husbandry, resigned, and Dr. J. T. Dinwoodie was appointed in the section of biological products in the division of veterinary science. A well-equipped cold-storage plant was completed (Pl. IV, fig. 1). The other buildings added to the equipment of the station included a new wing to the horse barn, two or three buildings in connection with the hog-cholera plant, a poultry brooder house, and a field laboratory for investigations in plant pathology.

All experimental work at the substations is to be organized on a project basis, formulated, approved, and reported in the same manner as are projects at the main station. The work of the substations is to be carefully harmonized with that of the main station and is to be carried on under supervision of the heads of departments. In addition to the general series of station bulletins a new special series has been established, in which will be published material intended for special distribution to particular groups of readers or localities.

Adams fund projects.—The work on the project of the soil chemist begun in Nebraska has been continued, and the data obtained in Nebraska are being worked over for publication. The work on this project includes the study of peat soils with a determination of the coefficient of hydroscopic moisture in connection with the wilting of plants. The hydroscopic coefficient on peat soils has been found to be very high. Apparently, however, it is independent of the organic matter in the soil. It seems to be associated rather with the fineness of the soil, increasing with the amount of clay and silt.

The study of the relation of chemical composition to age and texture of gray drift glacial soils made quite substantial progress. A large number of samples were taken of drift soils of different ages as determined by the geological survey. These soils are all of the same type. The object of the study is to determine whether there are differences

depending upon the age of the soils. A complete chemical study will be made with reference to the weathering of the soils but not with regard to productiveness. The organic content of the soil will also be determined.

In the investigation of the strength of wheat flour the chemical constituents of wheat proteids and their relation to the baking strength of flour are being studied. There appears to be no variation in baking strength of flour due to the relation between gliadin and glutinin. A beginning was made on the study of the enzyms of flour. The enzyms appear to be practically constant, but differences in their action arise as a result of differences in the stimulation of the yeast in the flour. The explanation of this phenomenon has not been found. The composition of proteins from flours of widely varying strength was carefully studied. The relation between proteins and the baking strength of the flour was found to depend upon the proportion of soluble proteins present in the flour. Apparently the soluble proteins are always present in smallest quantity in the flours of highest baking strength.

The food requirements for the rearing of stock and of meat production have now been under study for a period of seven years. The calves used in this experiment are all of the beef type. A record has been kept for the different groups of the total feeding constituents required for each 100 pounds of gain consecutively. At the end of each test the animals are slaughtered for analysis, and it is expected that the analytical computations will be completed during the coming year.

The investigation of the rusts of cereals proceeded actively. The work involves a study of the biological forms of rusts and of the relation of grass rusts to the occurrence of cereal rusts. Considerable hybridizing work is also carried on for the purpose of securing strains of cereals resistant to rusts and to determine as far as possible the nature of resistance. This investigation has been carried on chiefly with wheat, and work will be continued in cooperation with the chemical division of the station. Some of the crosses thus far obtained show considerable promise of being resistant, and the most promising hybrids have been distributed for further test. Much attention is being given to the gross visible features of resistance.

The project on the study of the principles of heredity underlying disease and climatic resistance in the apple, plum, and strawberry was continued at the fruit farm. In connection with this project a great deal of variety testing and selection is carried on. During the progress of the investigation much material has been accumulated which is being studied from the standpoint of inheritance of sterility, hardiness, and other characters. Some differences have appeared in susceptibility to rust in certain strains of the Wealthy apple. Crosses

were also made between the pear and sand pear, between varieties of plums and grapes, and also between varieties of strawberries, raspberries, and other fruits.

The new project on the chemistry of disease resistance in plants has been begun. Plans for attacking the problem have been organized, and workers have been assigned to various phases of the investigation.

Work with Hatch and other funds.—With the support of State funds the soil chemist is making a study of the soils of the southern tier of counties of the State. The field work of the division of chemistry included also about 150 tests with lime in regions where acid soil prevails and the growth of alfalfa with and without lime. A number of commercial-fertilizer experiments are also under way. In a study of peat soils it appeared that the chemical basis of classification is quite reliable.

In the division of agricultural chemistry considerable attention was given to a chemical study of wild rice. The results of this investigation are nearly ready for publication. A wheat survey of the State was carried on with reference to the milling qualities of wheat from the principal districts of the State and to the influence of environmental factors on wheat growing in different localities. The study of the influence of storage conditions on wheat, particularly temperature and moisture, were continued, and some progress was made in the study of the chemical life history of the wheat kernel. A special appropriation of $1,000 was received from the State for the study of sorghum sirup. An attempt is being made to learn the conditions under which a uniform product may be made, and promising success has attended this effort. Work on the production of alcohol from various crops and waste materials has been discontinued. In a study of the composition and quality of spring and winter wheats it appeared that variations in the composition and quality of wheat of the same varieties, grown in different seasons or in different localities during the same year, are attributable principally to varying climatic conditions rather than to the fertility of the soil.

The division of dairying and animal husbandry continued work on maintenance rations for dry brood sows, nutrition work with swine, measuring and accounting for the overrun in creameries, the nutritive value of silage cut at different stages of growth, and the study of contagious abortion. An investigation of problems connected with milk production showed that with the station herd the cows consumed daily an average of 16.25 pounds of nutriment. According to calculation, 7.41 pounds of this amount were required for the maintenance of the body, leaving 8.84 for utilization in the production of milk. In this experiment it required 1.86 pounds of net nutriment to produce 1 pound of product.

The work of the entomological division included a study of the habits and life history of the wheat-stem maggot, the larch sawfly, oak



FIG. 1.—COLD STORAGE PLANT USED IN REFRIGERATION STUDIES, MINNESOTA STATION.



FIG. 2.—APIARY, MINNESOTA STATION.



FIG. 1.—HORTICULTURAL GREENHOUSE, MINNESOTA STATION.



FIG. 2.—NEW BIOLOGY BUILDING, MISSOURI UNIVERSITY AND STATION.

twig girdler, orchard spraying, fumigation with hydrocyanic-acid gas, and an investigation of some of the problems of bee raising. Some attention was also given to miscellaneous insect pests of the orchard, forest trees, mill insects, and flies. In the apicultural investigation two more queen bees were successfully fertilized by artificial methods. Extensive observations were also made on the habits, life history, distribution, and means of combating the grasshoppers which occur within the State.

The division of agricultural engineering carried on several lines of study relating chiefly to farm drainage. A special study was also made of the selection and preparation of land for cranberry growing. It appeared that the cost of bringing a cranberry bog to the bearing point ranged from $500 to $1,000 per acre, and that 3 feet of fall below the outlet is necessary to drain the bog properly.

The division of plant pathology and botany carried on a study of the various diseases of forage and cereal crops, especially corn smut. It was found that the spores of corn smut do not live long in silage, and an attempt is being made to determine the conditions which kill the spores. A variety test is being carried on for the purpose of securing strains of flax resistant to rust and also to wilt. A general fungus survey is being made on the rotation plats of the station in connection with the study of the effects of systems of cropping and the accumulation of fungi in the soil. Much work was also done on spraying tomatoes, cucumbers, and potatoes for fungus diseases and on the study of variety resistance of plums to brown rot. A bulletin was issued regarding methods of testing seed for germination and for contamination with weed seed.

In the division of agronomy and farm management considerable attention was given to the growing of seed for distribution for a cooperative test by farmers and at the substation. Comparative experiments are also under way to determine the results obtained from the use of heavy versus light-weight cereal seed, acclimated versus imported seed oats, seed of different grades of oats, and seed from different portions of the oat head. A study is also being made of cultural methods for alfalfa, Sudan grass, millets, field peas, root crops, sweet clover, and various forage crops. An attempt is being made in cereal breeding to learn the mode of inheritance of certain characters. This work is confined chiefly to wheat, oats, and rye. The farm-management work of the station included the study of cost accounting, time requirements for labor in raising corn and sugar beets, and a survey of the development of farms on cut-over lands. A large mass of data was accumulated and published on the cost of producing various field crops in Minnesota and on the distribution and methods of controlling farm weeds.

In the division of agricultural economics attention was devoted chiefly to problems of marketing and cooperation. Careful statistics were collected from most of the cooperative organizations among the farmers of the State, and a special study was made of farmers' elevators, the marketing of hay, potatoes, and live stock, and the grading for inspection of grains. Of 2,013 cooperative farmers' associations in the State 614 were concerned with creameries, 270 with elevators, 115 with live-stock shipments, and smaller numbers with other farm operations.

The division of horticulture carried on a study of potatoes with reference to the degeneration of the tubers. In connection with this work 27 species of Solanum were secured for a comparative study. Most of them proved to be unsuited to the soil and climatic conditions of the station farm. Some progress was made in the study of hill selection of potatoes, and a number of very promising strains of potatoes were isolated. An investigation was also made of the manufacture of cider and vinegar in cooperative orchard management and in the study of various ornamentals and their uses.

An elaborate investigation was made of pollen development in the grape with special reference to sterility. It appears that cross-pollination brought about by mixing varieties at planting time has been the means of overcoming sterility. In grapes sterility appears to be due to the pollen rather than to the pistil. Since both sterile and fertile hybrids occur among cultivated varieties of grapes, hybridization is not necessarily a cause of sterility. There is apparently a tendency in grapes toward a diœcious condition, and this may result in the sterility of the pollen of a portion of the flowers.

The forestry investigations included studies in sowing the seed of forest trees, planting methods, nursery practices, forest management, mensuration, and windbreaks. In the veterinary division much attention was given to the study of normal blood of the hog. In this work counts are made of the number of red and white blood corpuscles, and determinations are made of the clotting time with percentage of hemoglobin and specific gravity. After violent exercise it was found that the blood clots more quickly and that the percentage of hemoglobin is higher. A study was made of the function of the thyroid gland as related to goiter in calves and lambs. Some attention was also given to ventilation of stables, contagious abortion, and swamp fever.

The following publications were received from this station during the year: Bulletins 133, Spore Germinations of Cereal Smuts; 139, Minnesota Weeds, Series II; Descriptions and Identifications—Eradication; 140, Investigations in Milk Production; 141, The Acridiidæ of Minnesota; 142, Selection and Preparation of Land for Cranberry Culture; 143, Minnesota Wheat Investigations—III, Composition

and Quality of Spring and Winter Wheats, Crops of 1912 and 1913; 144, Pollen Development in the Grape with Special Reference to Sterility; 145, The Cost of Producing Minnesota Farm Products, 1908-1912—Field Crops; 146, Statistics of Cooperation Among Farmers in Minnesota, 1913; 147, First Annual Seed Laboratory Report, 1913-14; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	207,093.90
Farm products	92,462.91
Miscellaneous	1,844.86
Total	331,401.67

The condition of the Minnesota station is satisfactory in all respects. The investigations carried on by the station cover a wide field and bear an obvious relation to the progress of agricultural science and to the welfare of practical agriculture in the State. The management of the station appears to secure an economical use of the funds at its disposal.

MISSISSIPPI.

Mississippi Agricultural Experiment Station, *Agricultural College.*

E. R. Lloyd, M. S., *Director.*

Several changes occurred in the staff of the Mississippi station during the year. H. B. Brown succeeded E. C. Ewing in charge of cotton-breeding work; H. K. Gayle was appointed animal husbandman and will devote his time wholly to the project on mule breeding; C. E. Wilson was made assistant entomologist; and E. P. Clayton succeeded J. K. Morrison in poultry work. The agronomist was made vice director. The energies of the station were largely devoted to investigations of mule breeding, cotton breeding, the bacteriological effects of green manures, the study of forage poisoning, and a number of practical problems connected with staple crops and the feeding of steers and mules.

Adams fund projects.—In the investigation of mule breeding a special effort was made to replace the grade mares previously used in this work with registered mares of different breeds. Some success was also had in replacing the jacks with others of superior merit. A large mass of data has already been accumulated in connection with this project, and with the present organization of work it is hoped that data of still more scientific value will be secured. The project as at present planned seems to be well devised to yield information of much value on the problem in hand.

The study of the inheritance of contrasted characters in cotton was continued actively. This work includes a study of heredity and

development in cotton, breeding of improved varieties of cotton, a study of adaptation to local conditions, and the determination of the amount of natural crossing. Considerable time was devoted to the study of factors concerned in the earliness of cotton, and in this connection records were kept of weather conditions as well as time of flowering and fruiting of the cotton plants. Satisfactory progress was made in the work of breeding superior early long-stapled varieties. In breeding for disease resistance additional information was obtained regarding the resistance of certain susceptible and resistant varieties. In connection with this work 20 or 30 of the leading commercial varieties of cotton are planted in a variety plat for the purpose of furnishing additional information on the characteristics and habits of these varieties for use in the scientific features of the project.

Decided progress was made in the study of bacteriological effects of green manures. It was found that there is a direct relation between the bacterial count and the amount of organic matter added to the soil. The quantitative bacteriological test and the crop yield were found to agree very uniformly. It appears that a light dressing of stable manure, together with green manure, gives a marked effect, as shown both by crop growth and bacterial count. The addition of a bacterial culture along with the green manure shows as great an effect as the addition of a light dressing of stable manure. This is taken as indicating that the benefit of the addition of stable manure is due largely to the addition of bacteria contained in manure.

The large mass of observations and data which have been accumulated during the study of the transmission of hog cholera by lice, birds, and other natural means is being digested and prepared for publication. The time and energies of the entomologist were quite largely consumed in work other than the projects supported by the Adams fund, but some progress was made in the investigation of the life history and habits of crawfish and of scale insects and insect pests of the pecan. Much additional information was acquired on the host plants and localities of several species of scale insects, and important data were also recorded on certain new species of these insects.

In work on the project on forage poisoning attention was given chiefly to forage poisoning caused by *Claviceps paspali* on *Paspalum dilatatum*. This grass is considered a valuable forage grass in Mississippi, but it is badly infested with *C. paspali* and other fungi. It was found that the sclerotia of *C. paspali* passed the winter in the soil. Feeding experiments with these sclerotia showed that they were poisonous to guinea pigs, producing characteristic symptoms. Death was caused by feeding 1 gram of the material. The sclerotia appeared to retain their virulence for many months after they had been dried. The use of Paspalum hay infected with *C. paspali* causes

serious poisoning in cattle, resulting in death if the hay is fed for a long period.

Work with Hatch and other funds.—Under the support of Hatch and other funds a considerable variety of field experiments in agronomy was carried on. In variety tests with cotton it was found that the medium-early varieties with big bolls gave the largest yields, but that some of the long-staple varieties were the most profitable. The wilt-resistant varieties gave the best yields for two years, but during the third year the yield fell below that of susceptible varieties on account of the attack of the boll weevil.

It appears to be unnecessary to use potash either alone or in combination for cotton on the soils at the station. On thin upland 200 to 300 pounds of an equal mixture of cottonseed meal and acid phosphate gave good results. A study of the cost of corn production during a period of four years on an area of 125 acres showed that on land free from Johnson grass the average cost of producing an acre of corn is $12.50, while this cost is increased about $2 per acre by the presence of Johnson grass. Nitrate of soda increased the yield of corn slightly, but this increased yield was obtained at a financial loss. In experiments with oats it appeared that while 1½ to 2 bushels of seed per acre gives satisfactory yields, considerably larger yields are produced by the use of 3 bushels of seed. Some attention was devoted to terracing lands and other methods of preventing erosion, variety tests with corn, cotton, cowpeas, soy beans, alfalfa, lespedeza, sweet potatoes, and crimson clover.

The department of animal husbandry carried on experiments in feeding mules and steers and accumulated a large mass of data on the cost of raising mules in connection with the mule-breeding project. Some feeding experiments with hogs were also conducted. The hog-feeding experiments included an attempt to determine whether the natural appetite of the animals may serve as a basis for preparing a properly balanced ration. In a mule-feeding experiment a comparative test was made of several kinds of hay. In their feeding value for mules these hays were found to stand in the order alfalfa, lespedeza, Johnson grass, timothy, and Bermuda grass. The experiment extended over a period of 89 days and included 2 and 3 year old mules.

In a feeding experiment with steers a comparison was made of cottonseed hulls and silage prepared from different materials. In this test results were obtained showing that corn silage is the most effective and that other materials stand in the following order as regards their value for silage: Sorghum, pea vines and Johnson grass, and corn stover. In this feeding experiment results showed that a profit was made from grain and silage feeding, while no profit resulted

when cattle were sold directly from the pasture without additional feeding.

The station gave some attention to the general problems connected with successful dairying and also to various lines of technical dairying and the management of a cooperative creamery. The veterinary department investigated the possibility of devising a method of serodiagnosis for pregnancy in mares. This test involves bringing together a sample tissue from a mare and blood serum from the mare to be tested. The method proved to be applicable when due precautions were taken to guard against sources of error from bacterial contamination and from digestive products in the blood. Considerable attention was required in the work of nursery inspection, and especially in field work on the suppression of citrus canker.

The following publications were received from this station during the year: Bulletins 165, Report of the Work Done at Holly Springs Branch Experiment Station, 1913; 166, Dairying on Cut-over Pine Lands; 167, Corn Silage Compared with Hulls for Fattening Steers; 168, Bacteriological Effects of Green Manures; 169, Cotton Experiments, 1914; 170, Corn; Technical Bulletin 5, Serodiagnosis of Pregnancy in Mares; Circulars, Mississippi Poultry House; Growing Hogs in Mississippi; and Express Cotton.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	35,153.85
Farm products	5,483.04
Miscellaneous, including balance from previous year	2,505.23
Total	73,142.12

Through its work at the three branch stations, the Mississippi station has opportunity to come in contact with many local problems and to bring the results of its investigation more prominently before the farmers of the State. In its investigational work the station is devoting its main energies to cotton and mules, which are considered two of the chief resources of the State. The work on mule breeding is organized on an extensive and generous basis and should prove of value not only to Mississippi but to all States in which mule breeding is an important industry.

MISSOURI.

Missouri Agricultural Experiment Station, *Columbia.*

F. B. Mumford, M. S., *Director.*

The general condition of the Missouri station and the progress of its work were satisfactory in all respects. A sharp differentiation in the lines of work is being brought about, and all research and

experimental work of the station has been placed strictly on a project basis. The station has adopted the policy of withholding approval of new Adams projects except to replace old projects which have been completed and reported upon. A determined effort is being made to free the investigating staff from teaching work. To this end teaching assistants are being provided. The legislature was generous to the station in its appropriations for the year, the total State fund for use of the station being about $139,000. Of this sum nearly $100,000 was available for expenses connected with station investigation. No important changes occurred in the station staff. There were a number of appointments and resignations among the assistants in the different departments of the station.

Adams fund projects.—Further experiments in the project on the factors affecting the properties of milk confirmed results previously obtained by the station on the effect of cottonseed meal and its by-products. A number of tests were made to determine the influence of various forms of roughage when fed in connection with cottonseed meal. A great number of chemical analyses have been made in connection with this work, but the results are not yet ready for announcement.

The study of the influence of nutrition of heifers upon their subsequent development was actively pursued. One heifer has been maintained from the age of 6 months to the age of 28 months on a ration containing less than one-half pound of digestible protein daily. The growth of the animal was retarded both in bone and other tissues, and a defective calf was produced. In another instance, with the addition of mineral matter a heifer was maintained for seven months on a protein ration of three-fourths of a pound per day. Detailed records are being kept of all the animals in the experiment, and it is expected that from these records normal curves of growth may be secured.

The project on immunity against hog cholera made active progress. Attention was given chiefly to the complement fixation test for use in the diagnosis of doubtful cases. Gratifying progress was made in the difficult process of preparing a specific antigen that will react with the serum of all immune swine. In this work 76 spleen extracts have been prepared and tested for antigenic properties. Of this number eight extracts yielded positive results. It is still doubtful whether the results obtained were due to a specific hog-cholera antigen in the spleen extracts or to associated antigens. Much attention was also given to the study of experimental antigens prepared from intestinal ulcers in cases of hog cholera.

The study of the dormant period in plants brought out many interesting and important results. It was found that bulbous plants have a pronounced rest period in summer. The use of ether and

other agents, which had been successfully used in breaking the rest period of woody plants, failed to stimulate the bulbs into growth. It appears, however, that the rest period of bulbs can be broken if they are kept at a temperature of 60° F. or lower after treatment. Practically all woody plants have a rest period that can be broken by artificial treatment. The roots were uninfluenced by any of the treatments, and it was found that the detaching of the twig from the tree had no effect on the resting bud. Growth always appeared first in the buds, whether they were connected with the root system or not.

Extensive experiments were carried on with the rest period of seeds. In general it appeared that seeds after drying for one month germinated more quickly and with a higher percentage than when planted immediately after maturity. It was learned that the specific effect of all the agents used in breaking the rest period of dormant wood was a stimulation of the enzyms.

Work on the nutrition of orchard and small fruits in relation to resistance to disease was carried on chiefly with plants in wooden pots containing 150 to 200 pounds of soil. No very specific results were obtained from the use of potash, phosphorus, or a combination of nitrogen, phosphorus, and potash. It was noted that apple blight attacked more severely the trees fertilized with nitrogen. In all cases, however, these trees gave a greatly increased growth. With potash alone the growth was less than in the check pots.

In studying the development of the various parts of the corn plant it was found that from the standpoint of moisture and nutrition the most important period in the growth of the plant is that between the time of the last cultivation and the appearance of the silk. The second period, however, is in general the most important of all three periods of growth as influencing the development of ear and the production of total dry matter. The lowest water requirement was found in potometers having an optimum water supply during the first period.

A distinct advance was made in the investigation of the use made of food by cattle at different ages. It was learned that heifers maintained on a low plane of nutrition produce as well-fleshed calves as those held on a higher plane of nutrition. A thrifty yearling steer which gained one-half pound a day on a low plane of feeding became thinner in flesh and at the end of a year showed a diminished tendency to growth and an increased tendency to lay on fat. In comparing the composition of the first and second 500 pounds of gain in weight during the growth of a steer it was found that the content of water, protein, and ash was considerably higher in the first 500 pounds, while the content of fat was much higher in the second 500 pounds.

The study of factors which influence the normal rate of growth in domestic animals was carried on during the year with beef calves. This project is closely affiliated with the project on the use of food. The beef calves were divided into three groups which received a low, a medium, and a high ration. During the year two of the calves on a low ration died. It was noted that this group of animals was especially susceptible to various ailments.

The principal work on the relation of the powdery mildews to their hosts was done in connection with the determination of the relation of varieties of wheat to wheat mildew and of oats to oat mildew. In this study 22 varieties of wheat were considered, and all except 3 of them showed 100 per cent of infection; 2 varieties remained entirely immune; while the third showed an infection of 75 per cent. Additional experiments with wheat mildew were conducted on 44 varieties of wheat which had been under investigation in previous years. Experiments on oat mildew were conducted on six species and varieties of Avena, and with one exception these oats showed 100 per cent of infection. *Avena barbata* proved to be partly resistant.

The problem of age as a factor in animal breeding was studied largely in connection with pigs. Complete records were made of 141 pigs born during the year. Of this number 58 were from immature mothers, 73 from half mature, and 10 from mature mothers. Thus far detailed observations have been collected on 615 pigs, and the sixth generation has been reached in the breeding of pigs from immature mothers. The records include careful body measurements of mothers and offspring, feed and weight, number and character of pigs, and other points of interest. The pigs from very young mothers appear to be somewhat less vigorous and smaller at birth than the pigs from older sows.

The investigation of Mendelian inheritance in domesticated animals was continued with poultry, particularly with crosses between Silver-spangled Hamburg and Brown Leghorn and between Sebright and Rose-comb Black Bantam. The chief matings between Silver-spangled Hamburg and Brown Leghorn were made for the purpose of attaining the third generation in order to test the apparent sex-linked nature of the inheritance of the spangled pattern.

Work with Hatch and other funds.—A great variety of experiments was carried on by all departments of the station under the support of Hatch and other funds. The animal-industry department carried on work with forage crops for pigs, the value of wheat in pig rations, comparisons of corn rations with and without tankage, the use of silage for horses, and a supplemental corn ration for hogs on rape. It was found that 2 pounds of silage would replace 1 pound of hay in horse rations. Wheat proved to be more valuable than corn

for fattening hogs, but required a supplemental feed high in protein. Hogs which had been held in the dry lot during the summer made more economic gains in the feed lot than those which had been kept on forage crops.

A study of methods for preparing corn for fattening 2-year-old steers has been in progress for three years, and the data obtained during this experiment are being prepared for publication. Clover hay and grain proved to be more efficient as a ration for breeding ewes than timothy hay with grain. It appears that moldy or sour silage is a dangerous feed for sheep. A ration of corn silage, clover hay, and grain proved to be the most efficient means of utilizing silage for sheep.

Comparative experiments indicated that oats planted late are most susceptible to the attack of smut. Tests were also made in comparing the susceptibility of different varieties of oats to smut. In all of these tests Early Ripe or Burt oats remained practically free from smut. Bordeaux mixture and lime-sulphur seem to be equally efficient in controlling apple scab, cedar rust, and blossom-end rot of the apple. The cost of spraying was less with Bordeaux mixture than with lime-sulphur. In treating apple trees for canker all diseased tissue was pared away, and the area was then disinfected and painted. A single treatment was effective in checking the disease in 82 per cent of cases.

The dairy department devoted much attention to a study of silage and silos. It was found that the temperature of silage as affected by the materials from which silos are constructed has been somewhat overestimated in importance. Apparently the chief problem for the proper preservation of silage lies in excluding air. No variation in the composition of silage was found to be due to materials used in constructing the silo. A thorough study was also made of silage from large and small silos and of methods for determining the capacity of silos.

In a farm-management survey in four townships data were collected indicating that the most successful farms were capitalized at from $70 to $95 an acre. A large mass of statistics was collected on the labor cost of producing corn, oats, wheat, soy beans, and cowpeas. In a study of the cost of using equipment on the farm it was found that the expense varied from 1.3 cents to 3.8 cents per horse hour. The average cost per year of keeping a horse was found to be $88.33, and the cost of keeping a milch cow $47.95. A rather elaborate study was also made of the relative proportion of different forms of land tenure in the State.

A wide range of experiments was carried on with field crops and methods of soil management. The addition of organic matter to the soil had no tendency to increase soil acidity. As a result of two

years' work it was learned that where corn and cowpeas are seeded together at the same time the growth of both plants is thereby limited. It appears that winter oats can not be successfully grown farther north than 50 miles north of the southern boundary of the State. Manure and inoculation appear to be two essential factors in making a success with alfalfa. A higher yield of soy-bean hay was obtained when the beans were planted 40 inches apart and cultivated than when planted in rows 8, 16, or 24 inches apart. Early deep plowing for wheat increased the yield over shallow and late plowing by 4 or 5 per cent.

Extensive experiments were carried on with corn, oats, barley, alfalfa, and cowpeas in the southwestern part of the State, and soil experiments were carried on in a number of localities. These experiments involved a study of the effect of cultural methods and of the use of various systems of crop rotation, green manure, and artificial fertilizers. A general investigation was made of methods of draining land and of the effect of drainage upon the moisture content and physical properties of the soil.

The horticultural department studied the influence of various methods of fertilizing, pruning, and cultivation on the development of fruit buds in apples and peaches. Spraying experiments for the control of insect and fungus pests were also conducted with a variety of insecticides and fungicides. Work in peach breeding was continued. The results thus far obtained show that purple color in the twigs is dominant in the first generation. Breeding experiments are also under way with strawberries and apples. An elaborate study was made of the economic results from spraying 25 orchards in different parts of the State. Some of these orchards showed a net profit of $160 to $400 an acre as a result of spraying.

These experiments indicated the desirability of spraying apple trees at least three times during the season—before blooming, immediately after blooming, and 10 days to 2 weeks later. In spraying for San José scale it was found that in badly infested orchards two applications are required—one in the late fall and one in the spring, before the buds open. Lime-sulphur and miscible oils appear to give equally effective results.

The following publications were received from this station during the year: Bulletins 118, Drainage Investigations on the Northeast Missouri Prairie; 119, Soil Investigations—Jasper County Experiment Field; 120, Rations for Breeding Ewes; 121, Land Tenure; 122, Inspection of Commercial Fertilizers for the Year 1914; 123, Experiments with Farm Crops in Southwest Missouri; 124, Results of Cooperative Spraying Experiments; 125, The Cost of Production on Missouri Farms; 126, Soil Experiments on the Level Prairies of Northeast Missouri; 127, Soil Experiments on the Dark Prairies of Central

and Northeast Missouri; 128, Soil Experiments on the Rolling Glacial Land of North Missouri; 129, Soil Experiments on the Red Limestone Upland of Southwest Missouri; 130, Soil Experiments on the Gray Prairie of Southwest Missouri; 131, Work and Progress of the Agricultural Experiment Station for the Year Ending June 30, 1914; 132, The Control of San José Scale in Missouri; Research Bulletins 8, The Killing of Plant Tissue by Low Temperature; 9, Carotin—The Principal Natural Yellow Pigment of Milk Fat—I, Review of the Literature Concerning the Yellow Plant and Animal Pigments; 10, Carotin—The Principal Natural Yellow Pigment of Milk Fat—II, Chemical and Physiological Relations of Pigments of Milk Fat to the Carotin and Xanthophylls of Green Plants; 11, Carotin—The Principal Natural Yellow Pigment of Milk Fat—III, The Pigments of the Body Fat, Corpus Luteum, and Skin Secretions of the Cow; 12, Carotin—The Principal Natural Yellow Pigment of Milk Fat—IV, (A) The Yellow Pigment of Blood Serum; (B) Carotin and Xanthophylls During Digestion; (C) The Pigments of Human Milk Fat; 13, Lactochrome—The Yellow Pigment of Milk Whey: Its Probable Identity with Urochrome, the Specific Yellow Pigment of Normal Urine; 14, Sap Studies with Horticultural Plants; 15, An Experimental Study of the Rest Period in Plants; 16, An Experimental Study of the Rest Period in Plants; Circulars 67, How to Build a Gurler Silo; 68, The Seeding of Meadows and Pastures; 69, The Fertility of the Soil; 70, The Hessian Fly in Missouri; 71, Shock Corn for Silage; 72, Silage for Horses and Mules; 73, Rye and Bluegrass Pastures, With and Without Grain, for Ewes Suckling Lambs; and 74, The Yellow Color in Cream and Butter.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	8,861.64
Fees, including balance from previous year	41,406.16
Miscellaneous, including balance from previous year	35,869.26
Total	116,137.06

The Missouri station is well organized, and the plan of work is well adapted for securing economic results. The research work carried on by the different departments of the station is of high grade and is constantly progressing. Moreover, the station receives active and sympathetic support from the farming population.

MONTANA.

Montana Agricultural Experiment Station, *Bozeman.*

F. B. Linfield, B. S. A., *Director.*

The work of the Montana station proceeded along lines of investigation previously adopted and without essential change. There were few changes affecting the staff of the station. Prof. P. N. Flint,

of the division of animal husbandry, was succeeded by Prof. C. N. Arnett. Mr. H. E. Murdock was appointed in charge of the station work in agricultural engineering; and R. F. Miller, assistant in animal husbandry at the station, was succeeded by R. R. Dodderidge. During the year the station severed its connection with the demonstration farms and devoted an increased amount of attention to substations. A new substation was started at Fort Assinniboine on a tract of 2,000 acres of land. The legislature appropriated $5,000 for the annual maintenance of this station.

Adams fund projects.—The project on the correlation of characters and of inheritance in pure lines and varieties made good progress. Attention was chiefly devoted to oats, and one-half of 28 pure-line selections were planted at the station and the other half at Cornell. The object of this work is to determine the relation of six or more characters in inheritance and to learn whether the correlation persists when the material is transferred to another locality. This material is used as a basis of selection of visible characters correlated with desirable invisible ones.

In a study of the relation of water loss to dry weight of plants the experimental work was done in potometers on two varieties each of wheat, oats, and barley. The cans were covered with sand and modeller's clay, and the amount of water transpired was determined by weighing the cans at the beginning and end of each test. Considerable differences in the amount of transpiration were found in different varieties.

The investigation of the conditions which favor the development of nitrate in soils has now been carried on for six years as a cooperative project by the departments of agronomy and chemistry. It was originally intended to make bacteriological studies in connection with this work, but thus far no such investigation has been carried on. Numerous analyses of soils are made from different plats of ground bearing different crops and cultivated in different ways. In this chemical work attention is devoted mainly to the determination of nitrates. It has been found that a higher percentage of nitrates occurs in fallowed than in cropped plats, that an accumulation of nitrates takes place in all plats except those planted to alfalfa and brome grass, and that in all cropped plats the percentage of nitrates is higher in the spring than in the summer or fall. In plats cultivated continuously to wheat the percentage of nitrates was lower than in plats fallowed in alternate years. The study of methods by which the light rainfall of the semiarid West may be made of use to the soil and retained for the use of crops is carried on in connection with the nitrate project, but little progress was made on that phase of the work during the year.

The data accumulated during the study of means of controlling the oyster-shell bark-louse were worked over and prepared for

publication. Much attention was given to the study of sugar-beet insects, particularly the root-louse and a species of sylphid. Experiments relating to the control of the sugar-beet louse by irrigation were continued in a number of localities. The results were encouraging as indicating the possibility of controlling insects by this means, but further work will be required to determine the adequacy of the method. The identity of the sugar-beet louse has not been definitely determined, but there is some reason to believe that *Pemphigus betæ* is an alternate form of a species which causes gall on the cottonwood. Much attention was also devoted to the life history of the unknown species of sylphid which occurs on tree roots. The use of poisoned bran mash for the control of this insect gave good results in one locality.

The study of conditions in the incubator as compared with those under the hen in hatching eggs was somewhat interfered with by the pressure of other work. There appears to be a relation between the lime and phosphorus content of the egg and the vitality of the chick. An attempt is being made to determine the factor which controls the assimilation of lime from the eggshell. Apparantly moisture, carbonic acid, and temperature are all concerned in this process.

The project on the physiological effects of arsenical compounds on vegetation was conducted cooperatively by the departments of botany and chemistry. The work on this project is nearly completed. During the year experiments were made in spraying the leaves in orchards and greenhouses, using different arsenicals and soaps. The weather was found to be an important factor in determining the effect of arsenicals. Injuries to the bark of orchard trees may appear below ground. In this work pure analyzed chemicals were used. The addition of soap greatly decreased the injury from Paris green and somewhat increased the burning effect of other arsenicals. Lime-sulphur added to calcium arsenite diminished the amount of burning.

The study of tree cankers and other diseases of orchard trees was carried on quite actively. The work on tree canker is nearly completed. Blackheart appears to be a form of weather injury which renders the tree more susceptible to canker. Collar rot, at first thought to be a form of canker, has been found to be due to a separate organism. This disease occurs quite extensively in various orchards, and an attempt is being made to secure stock resistant to the infection. A test was also made of the effect of heavy and light irrigation upon the development of the disease. Work was also begun on the new project on the brown bark-spot disease of fruit trees. No pathogenic organism has yet been found, although the disease appears to be infectious. It seems not to be due to winter injury and is apparently confined to the western part of the State. No success

has thus far been obtained in attempts to produce artificial inoculation.

Work was continued on the investigation of the effect of various factors upon wool and upon the form of sheep. A rather satisfactory system of testing the wool has been worked out. This method consists in the use of an optical lever. Pure Rambouillet ewes are used in this work, and the ewes have been divided into five lots, receiving different rations. The effect of the rations on length and strength of the wool staple and on the shrinkage and waste of fleece will be determined.

Work with Hatch and other funds.—A wide variety of experiments was conducted by the agronomy department. This work included variety tests with wheat, peas, barley, and oats, and tests of dates and rates of seeding flax and peas, irrigation experiments with cereals and legumes, fertilizer tests, especially with phosphorus, on cereals and legumes, studies of root development of 40 different crops in specially constructed boxes with one glass side, drainage investigations, studies of the duty of water with different crops, and of moisture requirements of plants under different degrees of soil saturation. The best yield of peas was obtained by planting early with a drill at the rate of 3 bushels per acre. Cooperative experiments were carried on in different parts of the State with varieties of corn, Sixty-day oats, Sudan grass, and other crops. A general study was also made of the status of winter wheat in Montana and of the baking properties of Montana wheat in connection with the State grain laboratory.

The general operations of the entomological department involved the study of grain insects, particularly the army cutworm and the western wheat aphis. The outbreaks of the army cutworm were unusually serious during the year. Good results were obtained by the use of poisoned bran mash. The western wheat aphis also appeared in serious numbers. The best method of controlling this pest is apparently found in keeping the field free of volunteer grain and certain species of grasses at critical times during the year. Data were also accumulated on a large number of injurious insects.

The veterinary work of the year covered some observations on poisonous weeds and a study of the tuberculin test on range cattle by the intradermal method. This method was used on large herds on the open range. It was found to be reliable and economic in respect to time, labor, and expense. Some attention was also given to the condition of hairlessness in pigs, a trouble which has appeared over wide portions of the eastern part of the State. A study of this disease is being carried on cooperatively by the veterinary and chemistry departments, but the cause of the trouble has not yet been learned.

In addition to the investigation of egg hatching under the Adams fund the chemical department carried on quite a wide range of experimental work. The chemist is cooperating with the horticulturist in work on the brown-spot disease and is also investigating the digestibility of clover silage and clover hay. In cooperation with the agronomist the chemist is making numerous analyses of soils. In connection with the soil work some attention has been given to the distribution of black alkali in the State and the effects of this salt upon crops, particularly orchard trees. The chemical department is also called upon to make numerous analyses of insecticides and fungicides according to State law.

The department of agricultural engineering is investigating the economics of pumping plants, the treatment of fence posts, and the economic disposal of sewage from country homes. The water table was considerably lowered in certain moist areas by the use of tile drainage and by open blasted ditches. In the field of botany and plant pathology a number of lines of investigation were actively pursued in addition to the Adams fund projects. These studies included the investigation of little-potato disease, fusarium wilt, and plum pocket. The use of self-boiled lime-sulphur gave almost perfect control of the disease, while unsprayed trees showed an infection of 65 per cent. The little-potato disease was less serious than in previous years. Methods of transmission of the cause of fusarium wilt and dry storage rots of potatoes received some attention. A general study was made of apple scab in Montana with reference to its distribution and economical means of controlling this disease.

The work of the animal-husbandry department included a comparison of forage crops for growing swine, a comparison of supplemental feeds for fattening swine, and a comparison of clover hay and clover silage in fattening calves and young steers. In a feeding experiment with pigs, in which grain was fed to different lots at the rate of 1, 2, and 3 pounds per 100 pounds of live weight, the most economical gains were obtained from the feeding of 2 pounds of grain per 100 pounds of live weight.

The horticultural work of the station included experiments in growing vegetables on dry land with the use of a straw mulch to obviate the necessity of cultivation, experiments with tomatoes, variety tests with various vegetables and fruits, seed selection of potatoes, a study of factors which induce premature seeding in celery, and experiments in the cultivation of orchards. The experiments in mulching vegetables with straw gave results unfavorable to the use of the mulch. The soil appeared to be cooler under the mulch, and the growth of the crops was retarded with the exception of cauliflower and cabbage, which seemed to receive some benefit. Experiments with tomatoes indicated that this crop may be grown successfully in the higher altitudes of the State when planted early

and properly cared for. Pruning and training of the vines were found to be decidedly beneficial from the standpoint of early maturity and the yield of fruit.

The work of the station on poultry consisted of breeding experiments for egg production, a test of the value of animal food in egg production, a study of the benefits from fattening roasters in crates, and an investigation of the cost of producing mature pullets. The results obtained at the station indicate that Leghorn hens may be profitably kept for egg production until they are at least 4 years old. Many of the hens of the station flock laid more eggs during the second, third, and fourth years than during their first year.

The department of farm management carried on agricultural surveys, a study of the economic status of wheat, and an investigation of cost accounting. It appears from a farm-management survey of the Gallatin Valley that farms on irrigated lands should contain from 200 to 400 acres to yield the best labor income, that farms on dry land should be about 75 per cent larger, and that the small size of the farms seems to be the most frequent cause of low returns from dry farming.

The following publications were received from this station during the year: Bulletins, 94, Clover and Corn Silage as Feeds for Dairy Cows; 95, Horse-feeding Experiments; 96, A Contribution to Our Knowledge of Apple Scab; 97, Farm Management in the Gallatin Valley; 98, Eleventh Annual Report of the State Entomologist of Montana; 99 (with appendix), A Report on Montana Climate; 100, Winter Wheat; 101, First Annual Report of the State Grain Laboratory of Montana; 102, Twelfth Annual Report of the State Entomologist of Montana; 103, Irrigation Development in Montana. Circulars 28, The Imported Cabbage Worm and the Cabbage Aphis; 29, Irrigation Practice in Montana; 30, The State Grain Laboratory and the Montana Seed Laws; 31, Care and Management of Sheep on the Farm; 32, Farm Butter Making—Creamery Industry in Montana; 33, Hog Cholera in Montana; 34, Artificial Hatching of Chicks; 35, The Alfalfa Weevil; 36, Fungicides and Insecticides for Montana; 37, Fruit Diseases in Montana; 38, Seed Testing; 39, The Status of Investigational Work on Pear and Apple Blight; 40, Flax Cropping, Harvesting Methods; 41, Corn Growing in Montana; 42, The Sugar-beet Webworm; 43, Farm Records and Accounts. Special Circulars 1, The Breeds of Pure-bred Live Stock; 2, A List of Breeders of Pure-bred Live Stock in Montana; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	40,900.80
Farm products	5,379.20
Total	76,280.00

The organization and business management of the Montana station appear to be in excellent condition. The station is accomplishing a large amount of work of obvious benefit to the agriculture of the State. Moreover, the relations of the station with the farmers and other citizens of the State appear to be cordial and sympathetic.

NEBRASKA.

Agricultural Experiment Station of Nebraska, *Lincoln.*

E. A. Burnett, B. S., *Director.*

An appropriation made by the State legislature became available during the year which provides about $800,000 for the construction of buildings at the agricultural college. It is proposed to erect a dairy building, a horse barn, a farm-mechanics building, and certain other buildings which will be used jointly by the agricultural college and experiment station. Dr. R. A. Emerson resigned his position as horticulturist, and Dr. R. F. Howard, a former assistant under Prof. Emerson, was appointed horticulturist. R. K. Bliss resigned his position as animal husbandman and Director Burnett was appointed as head of the department of animal husbandry, with C. B. Lee and H. J. Gramlich associates in animal husbandry at the station. The allotment from State funds for the maintenance of the main station was about $15,000 for the year, and the appropriation for substation work was about $32,000. The work of the station as a whole was carried on without change of policy or interruption.

Adams fund projects.—The project on food requirements of growing dairy cattle was started with heifers from birth and now involves the use of 7 animals, with the prospect of an increase to 16 in the near future. The heifers belong to the Jersey and Holstein breeds. One lot is maintained on a narrow and the other on a wide ration, each lot being subdivided so that some of the animals receive heavy and others light rations of these two types. Digestion trials will be carried out every six months during the course of the investigation.

The new project on winter injury was carried on actively during the year. This work involved making numerous grafts on different stocks for the purpose of testing stock and scion separately. A special refrigerating apparatus is being devised for use in this project. It is expected that temperatures as low as 20° F. below zero will be easily produced in this apparatus. The project is intended to be mainly a study of root injury, and work will be confined chiefly to the apple.

The study of the relation of insects to seed production in alfalfa has been under way for four years and has resulted in a large accumulation of data. The results obtained during the year were somewhat vitiated by unexpected weather conditions. It is still uncertain whether reliable quantitative results can be obtained in the study of this problem under present conditions.

The study of the water requirement of crops as related to plant characters and environmental factors yielded important results. It was found that the size of the potometer has a large influence on the plant and on its response to fertilizers. In small cans the increased growth from fertilizers is much greater than in larger containers. In order to avoid an excessively large factor of experimental error it is considered necessary to use relatively large containers in such work. Apparently the water requirement of nonsaccharine sorghums and corn is about the same, which fact would indicate that differences in drought resistance must lie in some other factor. The removal of the corn plant from its field surroundings and placing it by itself in the open had the effect of greatly increasing the water requirement. Oats and small grains were found to have a higher water requirement than corn per unit of dry matter.

Distinct progress was made in the project on the effect of thickness of stand in cereals. In this study the reserve food materials in the seeds are investigated, with a comparison of the conditions of large and small seed. While large seed obviously contained more reserve material, small and shrunken seed nevertheless produced nearly as large plants. In this work attention has been called to the apparent fact that the use of a fanning mill for a period of 13 years has had no material effect on the yield of grain. The use even of light, shrunken seed did not lower the crop yield 5 per cent as compared with the best quality of seed to be obtained. An attempt is being made to determine whether in the case of corn, competition in close-planted seed plats eliminates weaker strains, thus giving a basis for the production of better crops.

In continuing the investigation of the effect of the degree of inbreeding in maize, pollination was artificially performed in about 10,000 cases. Some of the corn which is now being used in this study has been inbred for five years and lacks vigor. A portion of it has become practically sterile. It appears that by recombining the original pure strains the vigor can be largely restored. In the further investigation of pigments in corn it appears that there are two pigments involved which it is very difficult to isolate.

The work of the station on prussic acid in Kafir corn and sweet sorghums was carried on with about 15 varieties of these plants, samples being taken weekly until the prussic acid had disappeared from the plants. The highest content of prussic acid was 0.01 per cent. The season was favorable for the growth of sorghum and therefore presumably unfavorable for the development of prussic acid. In any event the glucosid was not found in sufficient quantities for isolation.

The chemical study of silage made from alfalfa was carried on actively. This work involved the use of six silos, holding about a

ton each. Large cans coated with asphaltum were also used. A bacteriological study is being made of the silage, and 67 different species of bacteria have been investigated in this connection. The gases and the acids produced during the fermentation of the silage are receiving careful chemical attention.

In the investigation of new and little-known plant diseases particular attention was given to species of Fusarium causing rot and wilt and also to potato leaf-roll. The study of apple blister-canker with reference to the life history and pathogenicity of the organism resulted in the discovery of a perfect stage of the fungus. It will now be possible, therefore, to determine the time and method of infection.

Work with Hatch and other funds.—The work at the station in the field of animal industry included extensive experiments in the feeding of steers and pigs. An attempt is being made to secure reliable data on the ability of individual steers to utilize food, this ability being measured by economic gains. In feeding experiments to determine suitable rations for the production of baby beef it was found that a ration composed of alfalfa hay, corn silage, and corn gave the largest and cheapest gain and the most profit and that rations containing cottonseed cake gave about the same rate of gain but smaller profit than rations containing alfalfa. In a comparison of ground wheat versus whole wheat for fattening pigs it was shown that a great saving could be effected by grinding the wheat, that pigs could be fattened and marketed on a shorter feeding period with ground wheat than with whole wheat, and that, owing to the faster gains made and better finish obtained, a small quantity of tankage could be profitably fed with the ground wheat.

The dairy department carried on a comparative test of alfalfa hay versus corn silage for cows in 40-day periods. The results from the use of alfalfa hay appeared to be equal to those obtained in silage. Alfalfa silage proved to be not so palatable to cows as the corn silage, and therefore it gave rather inferior results. The dairy department succeeded in devising a cheap farm cooling apparatus for keeping cream. This apparatus has given excellent results and can be constructed at a cost not greater than $12. It is estimated that 5,000 of these cooling devices have already been put in operation in the State.

The horticultural department conducted a number of spraying experiments in which a comparison was made between various fungicides and insecticides in general orchard use. As a result of this work a large mass of data was accumulated on the efficiency of various materials and on suitable times for applying sprays. In the study of the blister canker of apples several hundred inoculations were made to determine whether there were any great differences in susceptibility. In addition to miscellaneous culture experiments with

horticultural crops the work in potato breeding was continued with about 175 strains of the Early Ohio potato.

A comparison of home-mulched versus northern seed potatoes brought out some rather important results. Since fairly low and uniform soil temperatures seem to be essential to the production of high-class seed tubers, the use of a sod mulch about the plat was studied. As a result of eight years' investigation of this problem, during which 22 different tests have been carried on, it has been found that the use of the mulch is very beneficial. As an average of the results for all of these experiments it was found that for each hundred pounds of tubers produced from mulched seed about 77 pounds were produced from unmulched seed.

The miscellaneous entomological work of the station included a study of the yellow-pine tip moth and methods for controlling the prairie dog.

The agronomy work for the year included a comparison of various methods of corn breeding, selection of wheat, rotation and fertilizer work, as well as the general study of soy beans and cowpeas. It appears that the adaptability of soy beans to the climatic conditions of Nebraska is much better than that of cowpeas. Varieties have been found that will mature before frost in practically all parts of the State. Soy beans, moreover, were found not to show the effects of drought as quickly as corn. Notwithstanding these apparent advantages, it is maintained that soy beans can not be considered sufficiently meritorious to take a place among the standard crops of Nebraska.

The following publications were received from this station during the year: Bulletins 143, Feeding Baby Beef—Forage and Grain Rations for Fattening Calves Under Western Nebraska Conditions; 144, Ground Wheat *v.* Whole Wheat for Fattening Pigs; 145, Handling Silage; 146 (with popular edition), Home-mulched *v.* Northern Seed Potatoes for Eastern Nebraska; 147 (with popular edition), Pork Production; 148, A Handbook of Nebraska Grasses; 149, Raising the Dairy Calf; 150, Soy Beans and Cowpeas; 151, Corn Silage and Alfalfa Hay for Beef Production; and Research Bulletin 5, The Storage and Use of Soil Moisture.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including amount used for substations	45,933.40
Miscellaneous, including balance from previous year	11,426.77
Total	87,360.17

The organization of the Nebraska station provides for the operation of the various departments in an effective manner and with cordial

cooperation. The station is in a satisfactory condition, and the quality of its work is good. While the station receives no direct appropriation from the State, the university has in recent years been generously disposed and has made quite liberal allotments to the station from its mill tax.

NEVADA.

Nevada Agricultural Experiment Station, *Reno.*

S. B. Doten, M. A., *Director.*

The year was one of readjustment for the Nevada station, and considerable progress was made in reaching a clear and definite policy and in reorganizing the management of the station with this plan in view. The veterinary department was strengthened, and additional equipment was secured for the new quarters in which it is carried on. A complete separation was brought about between it and the hygienic laboratory and the station. Dr. E. Records was appointed assistant in the veterinary department, and F. W. Wilson was appointed animal husbandman. The new president of the college, A. W. Hendrick, has taken an active interest in the development of the station and in making it a leading agency in the advancement of agriculture in the State.

Adams fund projects.—Little progress was made during the year in the study of equine anemia for the reason that material was not available. Only two minor outbreaks occurred during the year. It has been impossible thus far to produce the disease regularly by inoculation, and for this reason the cause of the disease is thought to be a filterable virus. Work on the new project on the hemorrhagic disease among cattle progressed actively. The symptoms of the disease are quite characteristic and are believed to indicate septicemia. Sufficient progress has been made to enable a preliminary diagnosis of the disease. For the present attention will be given to the possibility of preventing this disease by vaccination. A record is being kept of the outbreaks of the trouble, and autopsies of cases which occur in the field are carefully recorded. Preliminary plans were made for work on the new project on hog-cholera serum.

In the study of poisonous plants the investigation of poison hemlock was brought to completion. The active toxic principle found in this plant was obtained in a crystalline form, and a report upon this work was prepared and published. No satisfactory antidote for poison hemlock has been found. Attention will now be given to lupin seed and to death camas.

The project on the relation of nitrogen to the organic constituents of alfalfa made satisfactory progress. Attention was given in this work to the fatty acids and oils in alfalfa seed. A drying oil was ex-

tracted with ether and gasoline. Various salts were made from pure preparations of the fatty acids. This study is considered as being connected with the mechanism of nitrogen assimilation in alfalfa. Saponin was isolated from alfalfa, and it was found that glucose could be derived from it. The saponin is considered as the cause of bloat in cattle after eating alfalfa. Another glucosid not yet definitely determined has been isolated from alfalfa.

Little work was done during the year on the project relating to the essential oils of species of pine and desert plants indigenous to the State.

The study of the parasitism of the codling moth, previously carried on with the support of the Adams fund, was transferred to other funds at the close of the year. A quite close connection was shown between the prevalence of plant lice and the parasites of the codling moth. The field work which indicated this relationship was repeated the second year, and the results are so harmonious as to be considered fairly reliable. The parasitic insects which attack the codling moth are dependent during their adult life upon plant lice, scale insects, and nectar of flowers for food. If this material becomes unavailable the life of the parasites is greatly shortened.

In the project on meteorological and climatological observations with special reference to the occurrence of frost and its prediction, special attention was given to records taken on Mount Rose. The data collected during several years were being summarized and studied to establish any correlations existing between the high mountain conditions and the climate of the valley below.

The study of the influence of mountains and forests upon the conservation of snow has been pursued actively since 1909. This work involves observations at 12 stations at the level of Lake Tahoe and at several stations at higher levels, including Mount Rose. The depth and persistence of the snow are being studied on various kinds of surfaces in connection with the phenomena of accumulation and melting of snow. Certain courses have been laid out along which the snow measurements are made from the lower levels into the mountains. One object of this work is to develop a method by which the superficial run-off of water from melted snow in the basin may be estimated. The height of the lake, with corrections for evaporation, is the measure of this water supply from snow, and it is believed that the advance information in the spring as to how much water can be depended upon is of considerable advantage to the neighboring farmers. Estimates based on snow surveys as to the height to which the lake will rise have closely approximated the actual conditions which were observed later in the season. A pantograph has been devised by means of which the readings of recording instruments with widely different scales may be copied for comparison and study and

for permanent filing on a single sheet. An evaporation can has also been constructed for studying the rate of evaporation of snow on the crowns of trees.

Work with Hatch and other funds.—Aside from its Adams fund projects the veterinary department carried on experiments along a number of lines. The call for veterinary extension work has been met by assigning a veterinarian exclusively to that field of operation. A careful study was made of methods of controlling contagious epithelioma in chickens by means of vaccination. For this purpose the pseudomembranes formed in the progress of the disease were collected, finely minced, mixed with sharp sterilized sand, and triturated for one hour with a small quantity of normal salt solution. The mixture was then allowed to macerate in an ice box over night. Afterwards it was filtered through cotton, further diluted with normal salt solution, and attenuated in a water bath at a temperature of 55° C. for one hour.

This method of preparing the material, while somewhat crude, gave excellent results. Experiments will be conducted with a purified virus prepared under more carefully controlled conditions. The use of the attenuated virus as a vaccine brought about a complete cessation of death losses within 18 days after treatment, and in 40 days the outbreak of the disease was ended. This scheme of vaccination has been tested on about 5,000 fowls in all, and with excellent results. The vaccination method also gave satisfactory results in the control of fowl cholera. The veterinary department has begun a study of the results obtained from the use of anthrax serum. The present price of this serum is considered as almost prohibitive.

Quite a wide range of experiments was carried on by the agronomy department. This work included variety tests with corn, sorghum, alfalfa, barley, oats, and wheat. Data were collected concerning rates of growth and the dates of reaching certain stages of growth in the case of milo maize, Kafir corn, shallu, broom corn, and various other field crops. Irrigation experiments were in progress with sugar beets to which water was supplied in different amounts, from 2 to 6 inches, at different stages of wilting. Experiments in irrigation were also made with potatoes.

In the variety tests of the station with different forage crops an effort is being made to determine the varieties which show a special adaptability to local conditions by their hardiness and yielding capacity and to improve these qualities by selection. Some of the promising varieties are being tested out under different conditions of altitude and climate in various parts of the State. From experiments in irrigating sugar beets it appears that beets which are not irrigated until they wilt and fail to revive at night will not produce a satisfactory crop. The same result was obtained from the study of

the irrigation of potatoes and of clover. In irrigating clover it appears that on soils with a gravelly subsoil applications of 9 to 12 inches of water before the plants show the urgent need of water are required to produce the heaviest yield of hay.

In the case of wheat four 6-inch applications of water without any application at the 5-leaf stage produce a much heavier yield of grain than when five 6-inch applications were made, including one at the 5-leaf stage. No uniform variations were found in the nitrogen content of wheat from the varying amounts of irrigation water.

The principal lines of investigation of the entomological department were a study of cutworms and other insects affecting alfalfa and a study of means of controlling the European elm scale. An attempt was made to control cutworms by irrigation. During the progress of this work a bacterial disease appeared on the cutworms which made it impossible to determine the effectiveness of the irrigation water in killing them. The study of means of controlling the European elm scale has been carried on for five years. It appears that affected trees may be freed from the scale by washing with a stream of water applied with strong force. The results obtained in the application of this method during the five different seasons were very uniform. Some work was also done in the investigation of the death of bees in certain localities, apparently due to European disease.

No publications were received from this station during this year.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	3,696.40
Farm products, including balance from previous year	547.11
Total	34,243.51

The organization of the work of the Nevada station shows much improvement. The plans of investigations and experiments now contemplated relating the work more definitely and directly to the problems of agriculture in Nevada and to the development of agricultural industries. It is planned to make the research work of the station bear more directly upon the urgent needs of the farming population.

NEW HAMPSHIRE.

New Hampshire College Agricultural Experiment Station *Durham.*

J. C. Kendall, B. S., *Director.*

Certain administrative changes were made during the year for the purpose of making proper adjustment between station and extension work, so that the results of the station's investigations could be more effectively applied in extension work. There were no important

changes in the policy or work of the experiment station. F. S. Prince was appointed assistant agronomist. A few other minor changes occurred in the station staff.

Adams fund projects.—The project on sheep breeding was made one of the leading lines of investigation during the year. Since this project was initiated several changes in leadership have occurred, and while the data recorded by these different men have been preserved, the project has been somewhat handicapped by the frequent changes. Several improvements were made in the methods of keeping and digesting breeding records and in methods of making measurements and other observations. Certain features of the original project seemed to be inadequately planned or provided for, and were therefore abandoned. Record blanks have been devised for keeping a great range of measurements and other observations made during the continuation of the project. The individual score of each animal, as well as the score representing its family, is compared with the model score. Studies on wool characters are to be pursued actively. Attention will also be given to the subject of the inheritance of twins.

In continuing a project on water as a limiting factor in the production of corn it was found that the application of water sometimes reduced the temperature of the soil so greatly that the growth of corn was decidedly retarded. Moreover, in a time of heavy rains or floods on the surrounding lands there was a tendency of the water table to rise in the plats and thus interfere with securing the desired results.

The project on the control of fruit-bud formation in apple trees made distinct progress. It was found that the yield of Baldwin apple trees could be materially improved by proper cultural methods. It was observed that the formation of axillary fruit buds on the current season's growth is not uncommon with Baldwins and several other varieties of apple trees. The soil moisture in the sod plats was found to average somewhat higher than in clean-culture plats. Moreover, the formation of nitrates was greatly reduced in sod orchards. The formation of nitrates appears to be greatly stimulated by the application of calcium carbonate. In trees which bear in alternate years a heavier deposition of reserve food material was observed after the tree has formed fruit buds. Observations on the water requirements of apples indicated that trees bearing a heavy crop of fruit suffered materially when the moisture content was lowered to 7 per cent in a sandy soil.

Studies on heredity in vegetables were confined largely to melons and squashes. In an investigation of Mendelism in melons attention was given to form of fruit, color of skin, size of seeds, and fruit ribbing and netting. It was found that yellow color of skins is dominant over green color, round form of fruit over elliptical form, and netting of fruit over smoothness. In squashes also it was found

that the inheritance of color and form agree with Mendelian expectancies. Little progress was made in carnation breeding.

Further experiments were carried on to determine the possible stimulating or other effects of fungicides and insecticides on plants. During the year this work was confined to a study of Bordeaux and copper-ammonia mixtures as affected by moisture, light, temperature, and adhesiveness of the solution. The project on the toxic action of fungicides on parasitic fungi was in abeyance during a large part of the year.

The study of the life history and habits of the apple maggot was completed, and a bulletin on the subject was published during the year. The result of the attempt to destroy the apple maggots in the soil under the trees gave little hope of success from this method. Some beneficial results, however, were recorded from the use of kerosene emulsion and other oil preparations. The investigation of the habits of the apple maggot indicates that the essential point of control is in preventing infested fruit from decaying on the ground. It appears highly desirable that all windfalls be collected promptly and fed to stock or used for other purposes, so as to destroy the maggots. Work on the control of root maggots affecting cabbage and onion included further experiments with carbon bisulphid and other gaseous insecticides, as well as hellebore and tobacco, which may become diffused through the soil by leaching. The results from these experiments are not yet of a conclusive nature.

The availability of potash in soils was studied, particularly with reference to the production of hay on granitic soils. It was found that most New Hampshire soils are rich in potash, which is present as clay and in a mineral form. Calcium carbonate and unslaked lime have practically no effect on the solubility of soil potash. The field experiments indicated that potash fertilizers do not increase the yields of hay, particularly on clay soils. In connection with this project some work has been done also on the availability of phosphoric acid and nitrogen. In general it appears that the availability of potash is increased by frequent and thorough cultivation. The same result is obtained by proper rotation and by the use of sodium nitrate, ammonium sulphate, and acid phosphate.

The investigation of blossom-end rot of tomatoes was completed. During the course of this work it was found that tomatoes are most susceptible when in a stage of active growth and that either an excess or a deficiency of water may cause an increase in the extent of the disease. The disease appeared to increase greatly as the result of heavy applications of horse manure, or as the result of too high soil temperatures. The work of the station on this subject indicates that the disease is not due primarily to fungi or bacteria.

Work with Hatch and other funds.—On account of the difficulty of securing suitable land for experimental purposes near the station, much of the field work has been carried on in the form of simple experiments of a cooperative nature, in various parts of the State. The agronomic work included simple experiments in corn selection, variety tests with small grains, fertilizer experiments with grasses, alfalfa, and potatoes, and breeding work with timothy. A study of the effect of temperature of storage on the keeping qualities and culinary properties of potatoes is in progress. The study of suitable methods for controlling black flies and brown-tail moths was continued. Some attention was also given to a study of the toxic effects of lead arsenate.

The forestry work of the station included studies of the conditions necessary for the maintenance of successful nurseries and observations on the marketing of white pine. The inspection of fertilizers and seeds was continued, as heretofore. Some experiments were also carried on in determining methods of preparing Bordeaux mixture and in spraying and thinning fruit and the use of silage in the winter ration for the breeding flock of sheep.

The following publications were received from this station during the year: Bulletins 169, Analysis of Feeding Stuffs Made for the State Department of Agriculture; 170, Granitic Soil Potassium and Its Relation to the Production of Hay; 171, The Apple Maggot; 172, Mendelism in Melons; 173, The Fertilizer Inspection for 1914; 174, Results of Seed Tests for 1914; Technical Bulletins 7, The Relation of Temperature to Insect Life; 8, Bordeaux Mixture—I, Physico-Chemical Studies; 9, Studies in Fruit Bud Formation; Circulars 15, Notes on the Preparation of Bordeaux Mixture; 16, The Value of Silage in the Winter Ration for the Breeding Flock; and 17, Spraying and Thinning Notes, 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
Farm products	1,199.17
Miscellaneous, including balance from previous year	8,103.12
Total	39,302.29

The research work of the New Hampshire station is well organized, and it is also conducting experimental inquiries along many important lines. The station deserves more generous consideration from the State legislature in providing funds for strengthening its research work and for carrying on practical experiments.

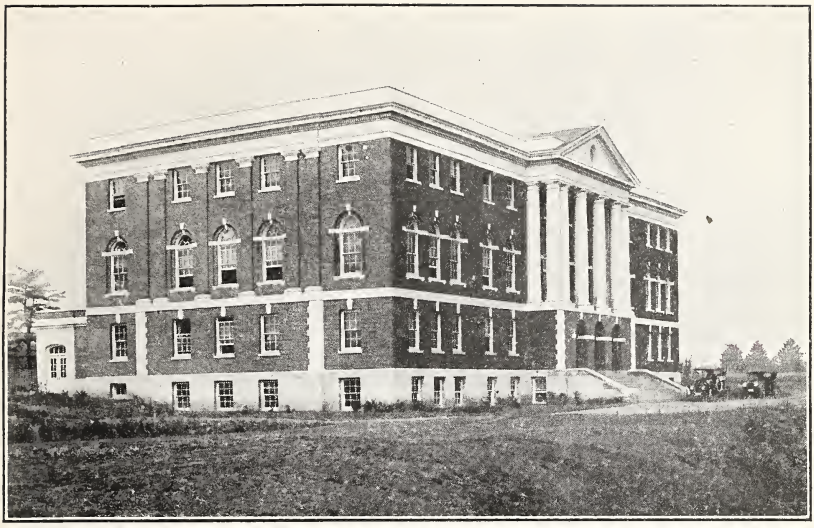


FIG. 1.—AGRICULTURAL BUILDING, CONSTRUCTION AND EQUIPMENT $100,000, NEW JERSEY STATION.



FIG. 2.—FERTILIZER EXPERIMENTS WITH PEACHES, RESULTS WITHOUT NITROGEN ON THE LEFT, WITH NITROGEN ON THE RIGHT, NEW JERSEY STATION.

NEW JERSEY.

New Jersey State Agricultural Experiment Station, *New Brunswick.*
New Jersey Agricultural College Experiment Station, *New Brunswick.*

J. G. LIPMAN, Ph. D., *Director.*

With the completion of the new agricultural building (Pl. VI, fig. 1) the headquarters for the station were transferred to the station farm, with the exception of the biologist and entomologist, which remained in the old agricultural building and an adjoining building. Research fellowships founded on funds furnished by commercial firms have been established in a number of departments of work, and both research fellows and research assistants have been appointed as beneficiaries of these funds. Both classes of men have college as well as station connection.

Several minor changes occurred in the station staff. I. L. Owen, associate agronomist, resigned and was succeeded by C. S. Van Nuis. Miss M. T. Pleasants, laboratory assistant in botany, and W. H. Pearson, assistant chemist, also resigned. The State appropriation to the station provided $25,000 for salaries and expenses, $20,000 for mosquito extermination, $4,000 for printing bulletins, $4,000 for the department of poultry husbandry, $3,000 for floriculture, $2,000 for seed control, and $900 for oyster investigations.

Adams fund projects.—In the work on the inheritance and correlation of structural characters in crosses, attention was given to corn, tomatoes, eggplants, beans, okra, and various cucurbits. A cross between a small variety of corn and popcorn was made with the result that ears of medium size were obtained in the first generation, but only very small ears in the second generation. The chief aim in this work is to ascertain whether there is any difference between reciprocal crosses, and wherever it is possible the reciprocal crosses are made between the same two individuals plants. It is believed that this eliminates a source of error that may have crept into many studies of reciprocal crosses where different sets of individuals were used, sometimes involving different seasons of growth.

The study of environment as influencing plant growth with special reference to the length of the hypocotyl was continued on radishes, corn, beans, peanuts, and other plants. In the case of the radish a comparison was made of the relation between the position of the seed in the pod and also on different parts of the plants to the actual vigor of growth of the resulting plant. For this purpose a flowering raceme was divided into an upper and a lower half, and it was found that the best seed was produced on the lower half of the raceme. In a study of the toxic effect of different amounts of salts upon the structure of various plants attention was given particularly to soy beans and *Solanum nigrum.* The work on this project, however,

was greatly interfered with by the resignation of the leader. Little progress was made in the project on the influence of varying physiological conditions on plant growth.

The soil investigations of the station were carried on under three projects. The cylinder and pot experiments were continued in the same manner as in previous years. In studying the accumulation and utilization of atmospheric nitrogen eight soil types are under observation in cylinders with a system of manuring and a 4-crop rotation. Some attention is also being given to the relation of the mechanical condition of the soil to the utilization of nitrate of soda, dried blood, and other sources of nitrogen. All factors which influence the protein content are being studied in connection with soy beans in pots.

The work on the availability of nitrogenous fertilizer materials included the study of cow manure, nitrate of soda, sulphate of ammonia, and dried blood in a series of cylinders. A beginning was made in the investigation of soil protozoa under the project which was organized near the close of the year. It was shown that protozoa are not particularly active in soil under average moisture conditions.

Work with Hatch and other funds.—In addition to its Adams fund projects the soils department continued its work on a series of plats receiving different fertilizers. In this work particular attention was given to the character of the herbage. Some study was also made of the comparative results from seeding alfalfa alone and with timothy, and on the continuous growth of wheat and rye as compared with these cereals alternated with legumes. In this work the chief purpose was to secure material for a study of the bacteriology of soils under different conditions. Some experiments were carried on to determine whether radioactive material might exercise any fertilizing effect. No appreciable effects were observed from the use of such material.

The work of the department of animal husbandry included experiments in maintaining hogs on various soiling crops and in feeding them garbage residue, together with molasses, tankage, and corn. A study is also being carried on regarding the application of Mendel's law to hybrid poultry, and some attention was given to certain poultry diseases and feeding materials for poultry, particularly mineral nutrients. Other lines of work in poultry husbandry included breeding for high egg production, a comparison of protein derived from animal and vegetable sources, the value of milk and milk products as poultry feed, experiments in caponizing, and a study of egg preservatives. The department of animal husbandry also carried on experiments relating to the resistance of swine to hog cholera and on the effects of inbreeding and crossbreeding pigs.

The efforts of the department of dairy husbandry were largely directed to a study of the cost of milk production, experiments in feeding ground alfalfa hay as a substitute for purchased concentrates in a grain mixture, and the accumulation of records of production and the cost of milk produced in tests of advanced registry.

In the department of plant pathology the chief investigations during the year included a study of brown blotch and black spot of the Kieffer pear, the use of spraying materials on tomatoes, spraying grapes for black rots, and the use of sulphur for the control of potato scab. Satisfactory fungicide methods were devised for the control of brown blotch of the Kieffer pear, and also of the common diseases of tomatoes. It appears that an application of 600 pounds of sulphur per acre will control potato scab quite satisfactorily. In work on this subject sulphur was applied in the fall either broadcast or in drills. The residual effect of the sulphur appears to persist until the second year.

One of the main lines of work in the entomological department was the study of mosquitoes. It appears that mosquito flight is favored by light winds and high humidity. The agency of fish in destroying mosquitoes in salt marshes proved to be more limited than had been assumed. In August the mosquito fish cease to inhabit the salt marshes and the number of mosquitoes increases correspondingly during that month. It was demonstrated that high degrees of salinity in water were destructive to the larvæ of *Aedes cantator* but not to *A. sollicitans*. Salinity of the water is therefore apparently the primary factor in the geographic distribution of salt-marsh mosquitoes. Of the various salts used as larvicides the best results were obtained from potassium chlorid and magnesium chlorid. Sulphuric acid in shallow water seemed to be more effective and cheaper than oil. In a study of flies it was found that ammonia is chiefly responsible for attracting flies to heaps of manure. In tests of soil insecticides it was found that the lethal dose of carbon bisulphid for the white grub was three-fourths ounce per square foot of soil. Experiments were also carried on with insecticides for flea beetles, on the biology of the bean weevil, and in the use of arsenate of lead and sulphur in the control of the strawberry weevil. The cost of this treatment for the strawberry weevil was about $8 per acre.

The horticultural work of the station included experiments with fertilizers in growing peaches on sandy soils (Pl. VI, fig. 2), the study of methods of shipping and distribution of peaches, a comparison of magnesian and nonmagnesian lime, both caustic and slaked, in the growth of roses, and pruning experiments with peaches. A record of the amount of growth pruned off in each treatment and of the yield in each tree has been kept in great detail, and similar records will be taken for one year more, or perhaps longer.

In the biological department of the station quite complete data were accumulated for forecasting the best time for planting oysters. It was also found possible to produce oyster larvæ by artificial fertilization. In further investigations the relation between the green color in oysters and the copper content was determined. In the region of Tuckerton, N. J., it was shown that the length of free swimming life of oysters is about two weeks and that oyster larvæ seek the bottom at night.

The following publications were received from this station during the year: Bulletins 265, The Ash and Protein Factor in Poultry Feeding; 267, Comparison of Magnesian and Nonmagnesium Limestone in Rotation Experiments; 268, Nitrogen Utilization in Field and Cylinder Experiments; 269, Methods and Results in Vegetation Experiments; 270, Ammonification Studies with Soil Fungi; 271, Concentrated Feeding Stuffs and Registrations for 1914; 272, Analyses and Valuations of Commercial Fertilizers, Fertilizer Supplies, and Home Mixtures; 273, Analyses of Materials Sold as Insecticides and Fungicides; 274, Analyses and Valuations of Commercial Fertilizers and Ground Bone—Analyses of Agricultural Lime; 275, Fertilizer Registrations; Circulars 37, The Typhoid Fly and Its Associates; 38, General Rules and Regulations Regarding the Conduct of Advanced Registry Tests in New Jersey; 39, Poultry Rations and Methods of Feeding; 40, Hog Cholera and Swine Production; 42, Spraying and Dusting White Potatoes; 43, Meadows and Pastures; 44, Common Diseases of Apples, Pears, and Quinces; 45, Common Diseases of the Peach, Plum, and Cherry; 46, The Hessian Fly; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

State station:	
State appropriation	$82,131.69
Individuals	12,850.00
Fees	41,796.71
Farm products	14,097.28
College station:	
United States appropriation, Hatch Act	15,000.00
United States appropriation, Adams Act	15,000.00
Total	180,875.68

The New Jersey stations are receiving generous support from the State and have become large factors in practically all of the problems which pertain to the agricultural progress of New Jersey. A further and sharper differentiation is contemplated between the strictly station work and other work which borders on the realm of extension.

NEW MEXICO.

Agricultural Experiment Station of New Mexico, *State College.*

FABIAN GARCIA, M. S. A., *Director.*

Quite satisfactory progress was made on the whole program of work at the New Mexico station, and a systematic effort was put forth to compile and digest several sets of data which had accumulated in some of the departments of the station as a result of previous experiments. The station adopted the policy of requiring all members of the staff to take sufficient time during each winter to compile and arrange the experimental data of the year's work, in order that the status of the work may be more clearly understood and necessary adjustments made for the coming season.

Mr. H. S. Hammond, botanist of the station, resigned his position in July, 1914, and Dr. R. F. Hare, chemist, severed his connection at the close of the year. Several minor changes were made on the staff, a few men being transferred to extension work. The State legislature made an appropriation of $5,000 per annum to aid in the maintenance of the station work. This is the first appropriation made to the station by the State. It is exepcted that it will be largely used in experiments in stock feeding, poultry work, and range investigation.

Adams fund projects.—The project on the nutritive effect of important feeds for the production of beef with range steers involved two digestion experiments with 2-year-old and 3-year-old steers, fed on alfalfa and milo maize. The steers were weighed daily and slaughtered at the end of 120 days. It was found undesirable to carry on a third period of this test on account of the approach of hot summer weather. The results obtained in this investigation thus far have shown that there is little difference between yearlings and 2-year-olds as regards the amount of feed consumed per unit of gain or the gains made per 1,000 pounds of live weight.

In the continuation of the project on the blight of the chili pepper a fungus was found in the root of the plant which resembles the organism of cotton wilt. Spores were obtained on dead chili stems in the laboratory, and the wilt was produced in healthy plants by inoculation. Cultures were made from these inoculation experiments, and further inoculations will be carried on to make sure of the relationship of the organism to the disease. The blight appeared to be more extensive in plats of heavy soil that were irrigated with ditch water.

A study of the relations of soil, water, and crop in respect to irrigation was carried on as a cooperative project between the agronomy and irrigation departments. It appeared that the deeper the soil the less the volume of water required for the production of a given quantity of alfalfa hay. The volume of water used in the production

of a pound of cured hay increased directly with the depth of each irrigation. Similarly the volume of water required per pound of cured hay varied directly with the total volume of water applied during the growth of the crop. The yield of hay per acre-inch of water was greatest when 2 inches of water was applied at each irrigation and diminished as the amount of the application increased to 5 inches. The total yield per acre, however, was greatest with the largest application of water. The water was pumped with a lift of about 80 feet, and the cost of pumping was approximately $8 per acre-foot.

The project on plant breeding with pure lines of cereals was confined to a statistical study of the structures of the oat plant. In this work constants were calculated for most of the factors under observation and the data obtained from the experiment have been compiled for publication. The project is considered as conpleted.

The study of the flow of water through submerged orifices was completed by the preparation of the experimental data and the publication of a bulletin giving the results of the investigation. The purpose of this study was to devise a reliable system of calibrating submerged orifices and to prepare tables for use in measuring irrigation water passing through such orifices.

The study of the efficiency of turbine centrifugal pumps was actively continued on three types of pumps. The results of these tests, except the efficiency tables, have been compiled and have been assembled and compared. It was found that the motor-efficiency curves supplied by the manufacturers were unsatisfactory and that computations as to the efficiency of motors were necessary before it was possible to determine the efficiency of the pumps.

The breeding of Mexican chili peppers involved a further study of the available strains of this plant. Certain forms have been obtained which are believed to be superior to those now on the market. One strain was eliminated for the reason that it did not show any promise of outstanding merit. Two of the more promising strains have been grown more extensively, and seed was distributed among 50 or more collaborators in different parts of the State in order to secure data on the behavior of these strains under different conditions.

Considerable improvement was made in the equipment and methods of conducting work on the study of the life history of the codling moth. Continued observations showed that only a small percentage of the eggs of this insect are laid in the calyx end of the fruit. Satisfactory results were obtained from four sprayings, but further work will be required to show definitely whether less than four applications of the spray will prove an efficient means of controlling the codling moth. For some time the attempt to determine the cause of the poor development of the Irish-potato tuber of New Mexico had yielded

unfavorable results. It is believed that the results obtained during the year will lead to the discovery of some of the limiting factors in the formation of potato tubers.

The study of alkali and plant food under irrigation and drainage conditions was actively prosecuted and gave results of considerable interest. Some progress was made in the improvement of methods for the determination of alkali in soils, with particular reference to the problem of determining the probable combination of the chlorin ions in alkali salts. Some progress was also made in devising methods for the more convenient determination of the portions of carbonates, sulphates, or other forms of salts in which the alkalis may occur.

Work with Hatch and other funds.—All departments of the station carried on experiments with the support of the Hatch fund. In the biological department progress was made in the study of the life history of the bean lady beetle and San José scale and in the study of the cause of chlorosis in trees. Investigations were conducted on the control of the grape leaf-hopper, peach worm, grasshoppers, peach twig borer, and cutworms. It was found that the grape leaf-hopper could be satisfactorily controlled by suitable cultural methods, by spraying the spring brood of nymphs with kerosene emulsion, and by capturing with traps overwintering adults in the spring before they lay their eggs. In the study of the chlorosis of trees it was found that the application of a spray of 1 per cent ferrous sulphate brought about a return of the green color of the leaves.

In the animal-husbandry department an experiment was carried on in feeding alfalfa hay to hogs. In this work it appeared to be more profitable to feed a ration of 2 pounds or more of grain per 100 pounds live weight than an exclusive ration of alfalfa hay. Further experiments with hogs on pasture indicated clearly the economy from feeding a reasonable quantity of grain during the pasture period. In a study of economic feeding for milk production it was found that cottonseed meal was a very profitable feed for cows when fed in rations of 1½ pounds per day, and that in such a ration alfalfa hay may be used more profitably than bran and with equal efficiency. At times of unusually high market prices for alfalfa hay it was found to be good economy to replace one-half of the alfalfa hay with silage. Corn silage proved most satisfactory, while silage from milo maize or Kafir corn seemed to be less desirable. In a steer-feeding experiment at the Tucumcari dry-farm experiment station, a comparison of milo maize fodder and cowpea hay showed the decided superiority of cowpea hay. In this test both lots of steers were fed silage.

A number of experiments were begun with poultry, including the effect of confinement as compared with free range on the fertility of eggs, the effect of adding moisture to the incubator on particular days during the incubation period, and a test of different solutions for the preservation of eggs.

The agronomy department cooperated with other departments of the station in several of its experiments, particularly an experiment in the cultivation of alfalfa. This is designed to furnish practical information on the cultural and water requirements and economic aspects of alfalfa. A combination of untoward circumstances brought about a poor stand for the first year, but the difficulties have been overcome, and the experiment is progressing satisfactorily. The agronomy department also has under way a long-time rotation experiment with legumes and nonlegumes, variety tests with cereals and nonsaccharine sorghums, a study of the cultural methods for various strains of corn, including standard varieties and certain Indian strains of corn, and an elaborate study of Sudan grass to determine the value of this grass for forage production and as a possible range grass.

The horticultural department continued its rather elaborate series of phenological observations on fruits, particularly apples, pears, and peaches. A beginning was made on the study of the extent of self-pollination in the bud of pears of several varieties. This study involves the inclosure of the buds in paper bags to prevent cross-pollination. Work of the horticultural department includes also a large number of miscellaneous experiments, including fertilizer tests for peach trees, orchard cover crops, irrigation of peaches, fertilizers for onions, and the study of the cultural requirements of onions, spinach, cauliflower, casabas, and various other truck crops and fruits.

The following publications were received from this station during the year: Bulletins 91, The Utilization of Feed by Range Steers of Different Ages—I, Alfalfa Hay; 92, Onions, Spinach, Cauliflower, and Casabas; 93, Soil Physics and Soil Moisture in Relation to First Year's Growth of Alfalfa; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
Farm products	1,710.46
Balance from previous year	4,042.32
Total	35,752.78

The station seemed to gain in strength and efficiency of internal organization during the year. The establishment of the extension service largely relieved the station staff from the burden of miscellaneous correspondence.

NEW YORK.

Cornell University Agricultural Experiment Station, *Ithaca.*

B. T. Galloway, B. A. S., LL. D., *Director.*

Progress in various directions, including organization, was made at this station during the past year. A new building, Caldwell Hall, costing $120,000, was completed and occupied by the department of soil technology. The animal-husbandry building, costing $111,000, was also occupied. Auxiliary poultry buildings amounting in cost to about $25,000 were nearly completed, and work on additions to the greenhouses to cost about $30,000 was begun. An appropriation for the preparation of plans for a plant-industry building was made by the legislature, and the preparation of plans was entered upon. During the year about 200 acres of the university farms, which now comprise 1,200 acres, were devoted solely to experimental work, while the remainder under college management also served to some extent in the accumulation of information in animal production and general farming.

Adams fund projects.—The studies of the laws of inheritance were carried on with crossbred corn, wheat, oats, barley, and morning-glory, and material was accumulated for similar studies of beans, and a beginning made in hybridizing potatoes. Second and third generations of many small-grain hybrids furnished material for a study of the inheritance of the various characters of these cereals. A number of interesting hybrids were obtained by crossing the common cultivated oats with wild oats. The species crosses of wheats gave valuable information in regard to the Mendelian behavior of various characters and were of interest in connection with theories concerning the origin of cultivated wheats.

Definite advance was made in the identification of genetic factors concerned in the heredity of characters in corn, the method of inheritance of some 20 pairs of such factors having been determined up to this time. Experiments with the morning-glory gave interesting results regarding color inheritance.

Pure-line studies were continued with wheat, oats, phlox, beans, and potatoes, and studies were also pursued on the inheritance and correlation of characters and bud variation in timothy. The work with wheat and oats gave valuable information regarding the possibility of the inheritance of variations within pure lines. The study of the amount of variation within tuber lines of the common potato was intensified by reducing the number of lines grown and by making more detailed observations on the individuals in the different lines. Offspring of single eyes was grown for detailed study with especial reference to color variations. In connection with the bud-variation

studies with timothy vegetative propagations from single individuals were increased as rapidly as possible, and data of a statistical nature were collected.

The investigations on the influence of environment in producing variations were carried on with daisies, wheat, and peas. Considerable variation was found to occur in the wild daisy, and data collected for five years showed variation within a single season as well as between different seasons. Asexual propagation was resorted to in studying the influence of environment on the same strain. Wheat and peas were grown in plats possessing different degrees of fertility, and statistical notes were collected in an effort to show the effect of different degrees of environment on the crops.

The soil-technology investigations included a study of the influence of higher plants, more particularly the common field crops, on the formation of nitrates. A study of the nitrate content of a soil under several different crops showed characteristic relationships between the plants and the formation of nitrates in the soil, as well as between formation of nitrates and the state of development of the plants. Depressing and stimulating effects were observed, and lysimeter and field experiments were conducted to determine the cause. Certain higher plants, notably maize, seemed to stimulate the formation of nitrates during the earlier stages of growth, while all the plants used in the experiment appeared to depress nitrification as they approached maturity.

The study of the influence of moisture on the availability of nutrients had reference mainly to the effect of changes in moisture content and of variations in the amount of organic constituents in the soil under constant moisture conditions. Nitrogen transformations appeared clearly influenced by the moisture content of the soil, while the solubility of mineral nutrients seemed not affected by moisture content extending over periods from several weeks to several years. At certain percentages of moisture the productivity of a soil was found to be greater when a variation in moisture content takes place than when the moisture content is held at the same point.

The fifth year's work had been completed on the removal of lime from the soil, and the results were partly summarized. It was found that treatments favoring the formation of nitrates were related to the loss of lime, the one increasing with the other. It was brought out by the experiments up to the present time that plants had a marked protective action in conserving soil calcium and, to a less extent, other bases as well as nitrogen. It was found that calcium was removed in the drainage waters most largely as a bicarbonate, but that from unplanted soil very large quantities pass off as calcium nitrate. In the lysimeter experiments 200 pounds more lime per acre was removed from the bare tanks than from the tanks growing

crops. It was further observed that the application of different forms of fertilizer also had an influence on the removal of lime from the soil.

Work with Hatch and other funds.—The work of the station supported with Hatch funds was along the lines of plant breeding, soil technology, and entomology. The work in plant breeding was largely supplementary to the Adams fund investigations. The improvement of small grains was carried forward actively. Many of the older selections and hybrids were tested further in regard to their yield and other qualities, and the seed of some was distributed for further testing by farmers. Many new selections of oats were grown, of which some gave indications of good yielding capacity and of possessing a strong straw. In the work with wheat numerous selections gave promise of a high yield and of good winter-resistant qualities. Over 1,600 new selections made from wheat fields in various parts of the State were under test in an attempt to improve the type of wheat now grown.

In the study of the methods of potato breeding the efficacy of hill selection was further confirmed by the results obtained. Good yielding strains previously isolated were propagated by mass selection to determine how long they will continue to hold up without hill selection. In connection with the timothy work the comparative testing of new varieties was increased so far as land was available, and closely inbred and crossbred seed from the same varieties was sown for purposes of comparison.

The department of soil technology studied the nitrogen balance in soils producing leguminous and nonleguminous crops for a period of years under conditions of high and medium fertility and with and without lime. The chemical composition and certain physical properties of some important types of soil were studied to ascertain whether the composition of a soil type as now classified is fairly uniform and characteristic. Experiments were also conducted to find out whether the soil type as now distinguished is an index to the fertilizer needs. Other fertilizer work included experiments on the value of clover as a fertilizing agent when grown with timothy, on the effect of acid and raw rock phosphate when used with heavy applications of barnyard manure or with only mineral fertilizers, and on the relative efficiency of different forms of lime. Attention was further given to the effect on production when the soil is cropped continuously without any of the mineral nutrients removed in the crops being replaced, and to the relative value of nitrate of soda, sulphate of ammonia, and calcium cyanamid when applied to timothy and other crops in rotation.

The department of entomology practically completed a biologic and ecologic study of the lessor migratory locusts conducted for the

purpose of obtaining an efficient method of control. A similar study on the hop grub and hop red-bug, pursued under controlled conditions in the hop region of the State, resulted in the discovery of new points in the life history of the grub or vine borer and a more complete knowledge of the life history of the red-bug, a new or little-known pest. Methods of controlling these insects were also established. Insects injurious to clover, together with the life history, injuries, distribution, and parasites of the same, received attention, and substantial progress was made in the study of the clover leaf-weevil and the clover seed midge. Outbreaks of the cherry leaf-beetle in different parts of the State were studied, and the results prepared for publication.

Investigations of the green apple aphis and the rosy apple aphis were continued; the number of generations and the length of each was determined; and the discovery that the rosy apple aphis lives during the summer on the plantain was confirmed. Experiments in conjunction with fruit growers in the control of these two aphids were carried on with promising results. Attention was also given to the poplar borer, the pine-leaf scale, and the fruit-tree leaf-roller, and observations were made on the injuries caused by various insects to the fruit of the apple tree.

Work in animal husbandry, botany, dairying, farm crops, farm management, floriculture, forestry, home economics, plant pathology, pomology, poultry husbandry, rural engineering, and vegetable gardening was supported from State, income, and other funds. The department of animal husbandry studied the relation of carcass yields to live weight in meat-producing animals to determine the causes of variation in carcass yields and to find a means of increasing the dressing percentage and the proportion of the live weight in the region of the more valuable cuts. Attention was also given to the curing of meat and meat products on the farm, with a view to outlining methods of preserving meat and meat products under ordinary farm conditions by natural and artificial means.

Investigations on the organic nutrition of plants were pursued by the department of botany for the purpose of throwing light on such questions as the influence of carbohydrates in plant growth, the toxicity of galactose and other sugars and the nature of antagonism between certain sugars, the secretion of enzyms by roots of higher plants, the assimilation of organic substances, their influence on anatomy, morphology, and on color production, the use of organic compounds by moss, and the physiological rôle of dextrose and levulose in plant nutrition. In addition to these subjects attention was given to maturation in *Vicia faba*, enzym production and secretion, inoculation of legumes, particularly alfalfa, the factors influencing or underlying root production in cuttings, the anatomy of wild

trees and shrubs in central New York, and the origin of inferior ovary in Ericaceæ and Juglandaceæ.

Data were accumulated by the dairy department on the effect of certain systems of inspection on a city's milk supply, the effect of temperature, lactic acid, and composition upon the coagulation of milk, and the effect of low temperature on the bacterial activities of milk. The influence of different methods and practices in reducing the bacterial count of milk was observed, together with the effect of pasteurization on the quality of milk for market purposes, and an effort was made to determine the specific gravity of butter fat in milk from various sources and its effect upon the accuracy of the volumetric fat tests and on the character of butter produced. The manufacture of commercial buttermilk, the analyses of condensed-milk products, the composition of dairy by-products, the moisture content of butter, methods of making ice creams and of making Cheddar cheese from milk of high acid content, and the manufacture of Camembert and Neufchatel types of cheese were also given consideration.

Work with farm crops included variety tests of corn and experiments in grass culture to determine the effect of different treatments on the life and production of grasses, the comparative value of different grass mixtures as well as of different varieties. Standard rotations were compared as to their relation to the yield and quality of a number of crops such as grain, hay, and potatoes.

The activities of the farm-management department related mainly to the cost of farm operations and practices, farm surveys to determine the important factors controlling the income, the cost of producing milk and potatoes, and the study of successful farms to determine the factors controlling success, especially with reference to the business organization.

In floriculture fertilizer and soil studies were made, and investigations were conducted with gladioli, irises, orchids, peonies, perennial phloxes, primroses, roses, and sweet peas.

The forestry department pursued studies of volume, growth, and yield, and conducted experimental fore t plantations, woodlot management studies and demonstrations, and made observations on methods of preservative treatment of fence posts and on the rate of growth of trees in mixed stands.

Work in home economics was largely confined to studies of household wastes in the uses of meats and methods of prevention, and of a family clothing budget.

Investigations in plant pathology were conducted relative to apple-tree diseases, including apple-tree canker, bean anthracnose, botrytis diseases, clubroot of cabbage, smuts, and fire blight of pears, and attention was also given to the relation of vigor of plants to disease,

the use of dry fungicides, and artificial immunization of plants. Studies were further made of crown gall and its control, and of diseases of gladioli and other bulbous plants.

The program of work of the pomological department included fertilizer experiments with bush fruits, the study of fruits as to color and hardiness, investigation of the causes of the June drop with fruit trees, marketing experiments, tests of new varieties of fruits, orchard pruning and planting experiments, scion selection, and a study of osmotic relationship and incipient drying in fruit trees.

The poultry department pursued quite actively an extensive series of experiments. The problems studied had reference to the effects of natural and artificial hatching on the hatching power of eggs, the viability of chicks and the egg production of hens, the inheritance of certain physical characters of eggs, the inheritance of constitutional vigor, especially sex-limited inheritance, and the characters that distinguish high and low constitutional vigor, the effect of close confinement during the winter, and of inbreeding on the vitality of the offspring and their laying qualities, the efficiency of certain methods of feeding, the time of egg laying, the comparative value of different types of trap nests, and the inheritance and distribution of egg production with the characters related to them. A very complete set of records was kept, and the data were carefully worked over for the purpose of establishing correlations.

The following publications were received from this station during the year: Bulletins 345, A Continued Study of Constitutional Vigor in Poultry; 346, The Tarnished Plant Bug; 347, Endothia Canker of Chestnut; 348, A Bibliography of the Writings of Prof. Mark Vernon Slingerland; 349, Some Important Factors for Success in General Farming and in Dairy Farming; 350, Potato Scab and Sulphur Disinfection; 351, Soil Survey of Orange County, N. Y.; 352, Effects of Variations in Moisture Content on Certain Properties of a Soil and on the Growth of Wheat; 353, The Interior Quality of Market Eggs; 354, Further Experiments in the Dusting and Spraying of Apples; 355, Two Factors Causing Variation in the Weight of Print Butter; 356, The Control of Apple Insects in Clinton County; 357, The Cost of Milk Production; 358, Some Important Leaf Diseases of Nursery Stock; 359, Some External Parasites of Poultry with Special Reference to Mullophaga, with Directions for Their Control; 360, Variations in the Tests for Fat in Cream and Skimmed Milk. Circulars 23, Outline of the Function and Use of Commercial Fertilizers; 24, Some Suggestions for City Persons Who Desire to Farm; 25, Outline of the Relation of the Use of Lime to the Improvement of the Soil; 26, Peach Cankers and Their Treatment; 27, The Curing of Meat and Meat Products on the Farm; 28, Apple Cankers and Their Control. Memoirs 3, Variation and Correlation of Oats (*Avena sativa*)—I,

Studies Showing the Effect of Seasonal Changes on Biometrical Constants; 4, Variation and Correlation of Oats (*Avena sativa*)—II, Effect of Differences in Environment, Varieties, and Methods of Biometrical Constants; 5, Physiological Studies of *Bacillus radicicola* of Canada Field Pea; and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$13,500
United States appropriation, Adams Act	13,500
State appropriation	48,125
Fees	6,820
Total	81,945

Although the Federal funds are restricted to a few departments, the large amount of investigation carried on by other departments with their general funds makes the showing a large and important one. Taken in connection with the other activities of the college for the direct aid of agriculture, the work of the station is broad and effective.

New York Agricultural Experiment Station, *Geneva.*

W. H. JORDAN, D. Sc., LL. D., *Director.*

There was no material change in the organization, lines of work, and financial status of the station during the past fiscal year. The series of 20 lysimeters the construction of which was begun the preceding year was completed, and studies of the soil and of drainage water were taken up. No additions were made to the staff, and the changes in personnel were few.

Adams fund projects.—The Adams fund work of the station, largely confined to the departments of chemistry, bacteriology, and dairying, embraced the same lines as in the preceding year, together with investigations bearing on the production of sanitary milk and on the means and methods of milk examination, similar work having been previously pursued under other funds. It should be stated that the amount of money received by the station under the Adams Act is sufficient to support only to a limited extent the work on the Adams projects. The studies on phytin and the phosphorus-bearing compounds in various grains and grain products were carried on during a portion of the year in laboratories in Germany and England, and satisfactory progress was made. The chemical identity of these compounds in the different grains was established, and certain difficulties encountered in the determination of several compounds in wheat bran were cleared up.

The investigations on the compounds of cheese and their changes included a study of the essential differences of cow's milk, goat's milk, and human milk, with special reference to the various salts contained therein, the chemistry of the casein, the souring of milk and its effect

upon various compounds, and of the composition of koumis made from cow's milk. Methods including a more accurate and reliable one for the determination of the acidity of milk were developed for the solution of certain phases of the problem in hand.

The result of the work on the important factors in the production of sanitary milk indicated in general that the cleanliness of the milker, the clean condition of the cow and the pail, and the care taken of the milk are the most important factors in securing a clean product. The principal studies on the influence of barn air in this connection included work on methods of bacterial analysis of air in which different aeroscopes were compared as to their efficiency for gathering bacteria from the air. Work on the development of a method for the more rapid and more practical examination of milk was carried on jointly with two local creameries and was conducted cooperatively in four other laboratories. Some of the results secured were published in bulletins of the Public Health and Marine Hospital Service.

Work with Hatch and other funds.—The horticultural department continued testing the fruits grown under the climatic conditions of the station and consequently had a large number of varieties under trial. Plant-breeding experiments in progress with orchard fruits, principally apples, involved work with about 20,000 seedlings. Hybridization was carried on with roses, orchids, and other flowering plants, and vegetative selection was practiced with violets. A report on the cherry, forming one of the well-known series, was completed during the year, and a similar work on the peach was under way. Fertilizer experiments on apples at the station were in their twentieth year, and 14 such experiments located over the State were conducted in cooperation with the soils department of the station. Trials of numerous kinds of stocks and of different methods of pruning were in progress. The pruning experiments included summer and winter pruning, light and severe cutting back, and other methods, with a view to arriving at all the fundamental facts underlying pruning practices. During the year this department published the results of a 10-years' test of dwarf apples, together with the data obtained in observations on the blooming season of hardy fruits, the ripening dates and length of season for hardy fruits, the inheritance of certain characters of grapes, and a number of new or noteworthy fruits, including grapes, peaches, cherries, plums, gooseberries, raspberries, and strawberries.

As in previous years the research work of the botanical department had to do mainly with problems in plant pathology, attention being given principally to the degeneration of potatoes as due to spindling-sprout disease, stem-end browning, and other tuber maladies. Studies of the causes of uneven potato stands had revealed the fact that these often result from the use of home-grown seed

which has become debilitated through growing in dry, hot soil. The affected tubers produce spindling sprouts, making weak plants, and efforts were put forth in cooperation with the Maine station to determine definitely the cause of the malady, which is referred to as the spindling-sprout disease. In a bulletin published on the subject during the year it is pointed out that this disease results from a weakened or debilitated condition of the seed tubers and that its appearance should always be regarded as an indication that the tubers are unfit for planting. Studies were also made of the influence of ventilation on stored potatoes to determine the importance of air supply and temperature. Much attention was also given to mosaic disease, leaf roll, and curly dwarf, and the apple-tree diseases, more particularly blister canker, collar rot, and other trunk and branch troubles. The comparative value of lime-sulphur and Bordeaux mixture, particularly in controlling potato diseases, was studied, and the results secured confirmed those of earlier experiments. Bordeaux mixture prevented tip burn to a considerable extent, made the foliage darker green, prolonged the period of growth, and increased the yield, while the use of lime-sulphur aggravated tip burn, dwarfed the plants, shortened the period of growth, and reduced the yield. No data regarding the value of these sprays in combating early or late blight were secured. Work on hop mildew was pursued under a special appropriation which expired June 1, when the work was discontinued. The results of the experiments carried on in this connection indicated the advisability of applying sulphur immediately after periods of wet weather in order to destroy the developing colonies of mildew. The percentage of efficiency of sulphur was determined, and it was stated that about 190 pounds was used per acre on an average for three years, and that the average expense was about $8 per acre per season.

The bacteriologist completed the dairy score-card work and published its results, and continued the study of the use of the milking machine and its care as related to the bacterial content of milk. A study of the effect of whey and skim milk pasteurization on the spread of bovine tuberculosis was pursued in cooperation with the State commissioner of agriculture. The soil work of the department included studies of the soil flora with reference to numbers, kinds, classification, and activities of soil organisms. Data secured in investigations on the increase in the number of bacteria in frozen soil and the best media for studying soil bacteria were published during the year in technical bulletins of the station.

The department of agronomy studied the nitrogen balance in soils in cooperation with the Cornell station, including as one of the problems the determination of the amount of nitrogen required for growing leguminous and nonleguminous crops. Laboratory studies were made relative to the principles involved in the reaction of lime on

soils, and field data and soil samples were collected in an effort to determine the lime requirement of typical soil areas within the State. A general limestone survey of the State with reference to the adaptability of the different limestones in agricultural use was completed, and experiments on 19 farms were in progress to ascertain the best treatment of soils of the Volusia type to enable them to produce alfalfa profitably. In a 6-acre field of hops in Otsego County methods of soil treatment and hop-variety improvement were studied, and a 12-acre experiment field at Baldwinsville was devoted to a study of crop rotation, fertilization, and questions of soil improvement generally in tobacco growing. Other fertilizer and soil-management experiments were continued in six orchards and two vineyards away from the station.

The entomologist studied the insecticidal properties of various substances and conducted experiments to determine methods of control for different pests, such as the apple aphis, pear psylla, thrips, sinuate borer, tree cricket, and certain grape insects, more especially the rootworm and the leaf hopper. Results of experiments were published indicating that plant lice attacking the apple should be destroyed at the time the buds are expanding and that nicotin solution, oil emulsions, or soap preparations are likely to be most effective.

In animal husbandry studies were made concerning the importance of calcium and certain other mineral nutrients in the food for poultry, with special reference to the fact that a deficiency of calcium is more likely to occur in rations for poultry than in those for other farm animals. In addition poultry-breeding experiments were continued, and the utilization and importance of coarse and succulent vegetable foods for feeding poultry were given attention.

The control work of the station was largely centered in the department of chemistry, and included the analysis of about 1,000 samples of fertilizers, 700 of feeding stuffs, and 200 of miscellaneous substances. Analyses in connection with insecticide control are made every other year.

The publications received from this station during the year were as follows: Bulletins 373 and 380 (popular edition), A New Method of Determining Milk Quality; 381 (popular edition), Some Fertilizer Tests in Vineyards; 382 (popular edition), Control of Cabbage Maggot on Early Cabbage; 383 (popular edition), How Sod Affected an Apple Orchard, II; 386, Inspection of Feeding Stuffs; 387 (popular edition), The Pear Psylla and Its Control; 388 (with popular edition), Tree Crickets Injurious to Orchard and Garden Fruits; 389 (with popular edition), Dead-arm Disease of Grapes; 390, Report of Analyses of Samples of Commercial Fertilizers Collected by the Commissioner of Agriculture during 1914; 391 (with popular edition), Ring-

ing Fruit Trees; 392 (with popular edition), Some Facts About Commercial Fertilizers in New York State; 393, Director's Report for 1914; 394 (with popular edition), Seed Tests Made at the Station during 1914—I, Inspection of Agricultural Seeds—II, Voluntary Examinations for Correspondents; 395, Further Studies on the Spread and Control of Hop Mildew; 396 (with popular edition), Effect of Various Dressings on Pruning Wounds of Fruit Trees; 397 (with popular edition), Lime-sulphur *v.* Bordeaux Mixture as a Spray for Potatoes, III; 398 (with popular edition), Milk Quality as Determined by Present Dairy Score Cards; 399 (with popular edition), The Spindling-sprout Disease of Potatoes; 400 (with popular edition), Ground Limestone for Acid Soils; 401, abridged, Strawberry Varieties; 402 (with popular edition), The Status of Spraying Practices for the Control of Plant Lice of Apple Orchards; 403, New or Noteworthy Fruits, III; 404, Inspection of Feeding Stuffs; 405, Potato-spraying Experiments at Rush in 1914; Technical Bulletins 32, A Contribution to the Chemistry of Phytin; 33, Preparation, Composition, and Properties of Caseinates of Magnesium; 34, Why Sodium Citrate Prevents Curdling of Milk—The Use of Sodium Citrate for the Determination of Reverted Phosphoric Acid; 35, Bacteria of Frozen Soil; 36, Organic Phosphoric Acids of Wheat Bran—I Concerning the Organic Phosphoric Acid Compound of Wheat Bran—II (Ninth Paper on Phytin), Concerning Inosite Monophosphate, a New Organic Phosphoric Acid Occurring in Wheat Bran (Tenth Paper on Phytin); 37, Studies Relating to the Chemistry of Milk and Casein—I, The Cause of Acidity of Fresh Milk of Cows and a Method for the Determination of Acidity—II, The Phosphorus Content of Casein—III, The Action of Rennin on Casein (Second Paper); 38, Culture Media for Use in the Plate Method of Counting Soil Bacteria; 39, Condition of Casein and Salts in Milk; 40, Concerning the Organic Phosphorus Compound of Wheat Bran and the Hydrolysis of Phytin—I, Inosite Triphosphoric Acid in Wheat Bran—II, Hydrolysis of Phytin by the Enzym Phytase—III, Hydrolysis of the Organic Phosphorus Compounds of Wheat Bran by the Enzym Phytase—IV, Phytin in Wheat Bran; 41, Fibrin; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$1,500.00
United States appropriation, Adams Act	1,500.00
State appropriation, including balance from previous year	153,345.00
Total	156,345.00

The New York State station continues to devote much of its time to research work and to give attention to a large number of problems encountered on the farms of the State, which often require more immediate solution.

NORTH CAROLINA.

North Carolina Agricultural Experiment Station, *Raleigh.*

B. W. Kilgore, M. S., *Director.*

A closer coordination of the work of the station and the State department of agriculture was brought about in the case of most of the departments of station work. The poultry investigations of the station have been placed under the general direction of the animal-husbandry department. F. B. Sherwood was transferred from the chemical department of the college and made assistant chemist of the station. A few other minor changes of staff occurred. Improvements were made on the buildings of the branch stations to the value of about $3,500.

Adams fund projects.—The investigation of apple and lettuce diseases was confined chiefly to a study of the causes of apple rots and of the manner of distribution of a Sclerotinia which causes lettuce drop. An attempt is being made to identify this organism. It appears to be the same as that which is commonly found on clover.

The study of nitrification involved the use of electrical conductivity as a measure of the rate of nitrification from day to day and of the amount and character of the products formed, including gases as well as soluble and insoluble solids. Preliminary experiments along this line were undertaken for the purpose of finding a solution in which nitrification may take place readily and in which there will be no chemical changes except as the direct or indirect result of nitrification. The difficulties connected with this method have not yet been entirely removed.

The relation of the geology and chemistry of soils to their productivity and fertilizer requirements received much attention. It was found that there is a close relation between the chemical and mineralogical composition of soils and their fertilizer requirements. The soils of the mountain and Piedmont sections of the State appear to be better supplied with potash, lime, and phosphoric acid than are those of the coastal plains. In the mountain and Piedmont sections of the State potash appears largely in the form of mica, while in the coastal plains feldspar is the chief source of potash. It appears that the phosphoric-acid content of most soils in the State is low and that this element is found chiefly in apatite. In the soils of the coastal plains lime is commonly less available than in those of the higher districts.

In studying the relation of suckering in corn to prolificacy records were taken of eight varieties of corn, grown with and without suckers. Both prolific and one-eared varieties were represented in this test, and the varieties were planted under various conditions of soil fertility in one-twentieth acre plats. One-half of each plat was

suckered and the other half was left to grow normally. It was found that only the highly fertilized plats produced a large number of suckers. The yield of both corn and stover was higher on the plats allowed to grow normally than on the suckered plats.

In the study of the genotypic constitution of cotton varieties 50 plants were selected from each of two common varieties of cotton in 1913. A photograph was made of each of the 100 plants, and notes were taken on the length of stalk, number of bolls, percentage of lint, length of fiber, and other characters. In 1914 the progeny of each plant was grown in separate rows for further study. All the progeny of the 100 selections was self-fertilized. In some of the rows all of the plants have proved to be remarkably uniform, while in other rows a great lack of uniformity prevails, due apparently to the hybrid nature of the type. The results obtained from the study of place effect upon cotton characters have not yet led to definite conclusions.

Further data were accumulated as the result of observations on sterility in blackberries and dewberries. In the project on the transmission of characters in hybrids of rotundifolia grapes it was found that the scuppernong and all other white-fruit bearing vines, together with all light-colored male vines, are pure for the white color, and that they do not carry the dark color as a recessive factor. It also appears that self-sterility alone is not responsible for the small-sized fruit clusters which sometimes appear.

The study of the life history of the corn billbug was practically completed. Work on the gloomy scale was directed chiefly to the determination of the host plants of this insect and the possible migrations of the insect in different generations. Soft maples appeared to be more subject to attack from the gloomy scale than were hard maples. In some tests of methods of control it appeared that soluble oils were more effective than lime-sulphur.

The investigation of the toxicity of cottonseed meal for hogs brought out some interesting results. Gossypol was extracted from cottonseed kernels and was found to possess toxic properties. Ethyl ether was used as the solvent after the oil had been extracted from the kernel by gasoline. By evaporation a crude gossypol extract was obtained, which was later obtained in a crystalline form as gossypol acetate by precipitation with acetic acid. Gossypol was found to be toxic and fatal to rabbits when administered either in the form of the extract or acetate. The cottonseed kernels were rendered less toxic by the partial extraction of gossypol. This body forms an oxidation product which is not toxic. It is planned to devise a method of completely extracting gossypol from cotton seed or of changing the gossypol to a physiologically inert form by oxidation.

Work with Hatch and other funds.—The station continued its rather elaborate study of the effect of different feeds upon the composition

and quality of pork, mutton, and beef. In experiments with hogs attention was given chiefly to the study of feeds which may be mixed in a ration so as to overcome the tendency of soy beans and peanuts to produce soft pork. A number of experiments were begun in poultry husbandry, including a test of the feeding value of sour-milk rations for reducing the mortality of chicks, experiments in fattening fowls, and in breeding for egg production. The dairy work of the station included a study of methods of making cheese in connection with cheese factories in the western part of the State. Experiments were also carried on with cottonseed meal as a feed for calves, and silage was compared with dry feeding for cows. A test was made of a number of methods for removing the onion flavor from milk. Feeding experiments with beef cattle were concerned largely with the question of the safe and profitable use of cottonseed-meal rations and of the replacement of cottonseed hulls with silage.

The soil survey of the State was continued actively, and surveys of five counties were completed during the year. The station is preparing for publication a series of regional reports on soils. The work on field crops included the study of prolificacy in corn, fertilizer experiments with cotton, corn, wheat, oats, red clover, potatoes, and tobacco, breeding experiments with cotton and vetch, and variety experiments with cotton, cowpeas, and soy beans. The soy bean is becoming an important industry in North Carolina, and the station is devoting much attention to the improvement of this crop and the possible extension of the area devoted to it.

The profitable combination of fertilizers has been found to pay moderately well when applied to corn on sandy loam and clay loam soils. The use of a suitable fertilizer mixture gave an average increase of 69 per cent in yield and a net profit of $6.60 per acre. The experiments thus far carried on with fertilizers for corn show that phosphoric acid and nitrogen are the important plant-food constituents in increasing yields at a profit. As a source of nitrogen nitrate of soda gave somewhat better results than dried blood. Larger profits were obtained from the use of fertilizers on cotton than on corn. It was found possible by means of fertilizers to increase the yield of seed cotton 43 per cent over that obtained without fertilizers, and with a net profit of $15.14 per acre. The experiments in applying fertilizers to cotton showed that phosphoric acid is the controlling constituent for increasing yields and adding to the profits of the cotton grower.

A special branch station for tobacco experiments was established, and various lines of work in plant breeding and plant pathology were also carried on there. This work included the breeding of wilt-resistant strains of watermelons, the breeding of strains of cotton resistant to anthracnose, and of cabbage resistant to yellow-sides

disease. Some work was also done on apple canker and the shedding of peanuts as the result of fungus disease. The work on the plant-disease survey and on chestnut diseases was continued. Studies were in progress on cowpea weevils, insect pests of pecans, and the cornstalk borer.

The horticultural work of the station included cultural experiments with pecans, summer apples, peaches, grapes, strawberries, potatoes, cucumbers, and other fruits and truck crops. Considerable attention was given to the essential features of construction and management of air-cooled storage houses for apples.

The following publications were received from this station during the year: Bulletins 227, Fertilizer Experiments with Cotton on Piedmont Cecil Sandy Loam Soil and Varieties, Culture, and Fertilization of Cotton on Piedmont Cecil Sandy Loam and Red Clay Soils; 228, Air-cooled Apple Storage Houses; 229, Fertilizer Experiments with Corn on Piedmont Cecil Sandy Loam Soil, and Varieties, Culture, and Fertilization of Corn on Piedmont Cecil Sandy Loam and Red Clay Soils; Technical Bulletins 9, Relation of the Mineralogical and Chemical Composition to the Fertilizer Requirements of North Carolina Soils; 10, Breeding Rotundifolia Grapes; Circulars 16, Results of Variety Tests of Cotton in Mecklenburg County; 17, Boys' Corn Club Work in North Carolina; 18, Fertilization and Cultivation of Corn, Cotton, and Tobacco; 19, Some Important Diseases of Tomato in North Carolina; 20, Rape for Hog Pasturage; 21, Improving Cotton by Seed Selection on the Farm; and 22, Beef-cattle Production and Cooperative Breeders' Organizations.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
Farm products, including balance from previous year	17,498.24
Total	47,498.24

Perhaps the most important scientific contributions of the North Carolina station during the year were made in the investigation of soils, cottonseed meal, and animal feeding. The practical work of the station was continued actively, especially at the branch stations, and important progress was made in a study of marketing conditions. With the aid of its substations the station is covering quite thoroughly the principal agricultural problems of the entire State.

NORTH DAKOTA.

North Dakota Agricultural Experiment Station, *Agricultural College.*

T. P. Cooper, B. S. A., *Director.*

The State legislature at its last session provided for a board of regents to have charge of all State educational institutions, including

the agricultural college and experiment station. The director of the station is also director of extension work. Prof. J. H. Shepperd was relieved of all college work during the year, and has thus been able to devote his energies entirely to the station. The legislature increased the appropriation previously available to the station, the State maintenance fund for the station being $25,000 a year. This fund is used largely in supplementing the Hatch and Adams funds. A special appropriation of $10,000 was made for live-stock work, and one of $3,500 for dairy work. An appropriation of $3,500 was voted to the station for use in the extermination of ground squirrels. There were also appropriations for the branch stations. W. H. Peters, in charge of the work in animal husbandry, was succeeded by G. W. Jones.

Adams fund projects.—In the study of swamp fever in horses the experiments of the past year were carefully reexamined for the purpose of checking up the results thus far obtained in diagnosing the disease by means of antigen. It appeared impossible, however, to find an antigen which could be depended upon to furnish a reliable diagnosis. Certain animals appear to be carriers of the infection. It has been found extremely difficult, however, to detect all these individual animals. For the present it has been decided to abandon the method of complement fixation and to try another method, in which the serum will be precipitated. The use of a mercurial arsenical in the treatment for swamp fever proved to be inefficient. Horses thus treated appeared to recover, but continued to be carriers of infection.

The project on the fundamental facts underlying the development of the hog-cholera immunity and hyperimmunity was undertaken on account of the great difficulty experienced in making a satisfactory serum. The quality of the virus appears to be important in securing a good serum. Complement fixation as a possible means of determining the quantity of antigens has not given much promise of success. During the year, however, a method was devised for preparing an efficient and reliable serum, and this serum is now being distributed throughout the State.

The investigation of the milling qualities of wheat proceeded satisfactorily along the restricted lines of inquiry adopted in a reorganization of the project. The composition and baking qualities of various wheats have been compared. An attempt is being made to establish correlations between the composition of the wheat and its milling and baking properties, using wheats of known varieties and origin. By a process of elimination it is hoped to determine just what qualities affect these milling and baking properties. The work at present is with wheats which show quite different qualities, and the milling and baking tests are used in selecting material for chemical study.

Determinations were made of the ash, of organic and inorganic phosphates, and other constituents. From the data thus far accumulated, however, no definite correlations have been established, but certain suggestive hints as to future work have been secured.

In the study of the organic matter of soils an effort is being put forth to ascertain the relation between the cropping capacity of the soil and the character of the organic matter. For this purpose soil samples are taken from plats on the farm either cultivated in wheat continuously or in crop rotations. The organic and inorganic forms of phosphorus, potash, lime, and other constituents are determined with special reference to the phosphorus content. The plats upon which this work is done have been under observation for 22 years. A virgin plat studied in connection with this work has remained neutral in reaction, while the cultivated plats have become acid. More humus is found in the soil in the continuous wheat plat than in the plats under rotation.

In the continuation of the project on factors influencing the action of microorganisms on the liberation and accumulation of available plant food in the soil satisfactory progress was made during the year. It had already been found that a number of ammonifying organisms could themselves make use of ammonia, and this finding was confirmed during the investigations of the year. The organisms in question are shown to be able to ammonify casein except in the presence of dextrose. The work involves a study of the balance to be maintained and the actual relationships of the organisms in the soil. It appears that early plowing allows the bacteria to use the available excess of energy so that they do not take up plant food. Corn has been grown in synthetic cultures of bacteria. When nitrates were added in increasing quantities with dextrose it was found that dextrose caused the bacteria to take up nitrogen in the nitrate form.

The problem of the resistance of flax to wilt received little attention during the year, primarily for the reason that the project on the action of microorganisms on the liberation of available plant food demanded so much time and energy. In the investigation of fusarium wilt in potatoes a special effort was made to isolate various species of fungi associated with an infection of the fibrovascular system, and many inoculation experiments were made in the greenhouse. It has been impossible thus far, however, to reproduce the symptoms which were commonly observed in cases of infection in the field. The indications are that the disease is due partly to a microorganism and partly to climatic or soil conditions.

Work with Hatch and other funds.—The veterinarian continued his study of tuberculosis in birds and mammals. Rabbits were used in maintaining strains of both human and avian tubercle bacilli. When

the mammalian form of tubercle bacillus was fed to sparrows it caused their death without apparently producing a true infection. The tubercle bacilli were recovered from the liver. An inoculation of guinea pigs with this material, however, produced death. Reinoculation of the material from guinea pigs into chickens caused death without the development of a true infection. The fowls, however, became carriers and communicated the disease to guinea pigs. It is believed that fowls may become carriers of mammalian tubercle bacilli by picking them up in manure and reconveying them to cattle and chicken feces. In the further study of hog cholera an effort has been made to secure young pigs from farms at the first appearance of any suspicious sickness. It has been found possible in this way to locate outbreaks of hog cholera in time to apply inoculation and save the rest of the herd.

The chemical department carried on an extensive study of oils and paints with particular reference to linseed oil and soy-bean oil. An effort is being made to determine the differences between the oils of different grades of flax. The study of soy-bean oil is of a cooperative nature, the material being obtained from various parts of the United States. Much miscellaneous analytical work was done by the chemical department, particularly on waters sent to the station from various parts of the State for examination. Analyses were made of various weeds to determine the amount of potash and phosphorus which they removed from the soil, and also of corn plants at several stages of growth in order to secure information on the relative amounts of nutrients in the plants at these different stages. The control work of the chemical department has been segregated from the other lines of work. Some attention was also given to the sucrose content of sugar beets grown in various parts of the State.

The botanical work of the station included the identification of plant diseases from material sent in by farmers and breeding and selection experiments with flax for the purpose of securing resistance to the fusarium wilt. A number of crosses were made between immune and nonimmune strains of flax, and the immune strains were distributed to farmers for cooperative experiments to determine their behavior under field conditions. Some experiments were also carried on to learn the effect of chemicals applied to the soil upon the development of flax wilt and wheat rust.

In a study of methods of combating ground squirrels excellent results were obtained from the use of a poisoned bait. The bait was prepared by mixing 1 ounce of powdered strychnin and 1 ounce of baking soda, which was then sifted into three-fourths pound of thin hot starch paste and stirred to a creamy mass. To this material one-fourth pound of corn sirup and a tablespoonful of glycerin were added, and the whole thoroughly stirred. A further addition of

one-eighth ounce saccharine was made. Where this poison was distributed about 90 per cent of the ground squirrels were destroyed. Observations were also made on the distribution, habits, and life history of the mammals of North Dakota.

The work of the agronomy department was somewhat interfered with by lack of proper drainage. All of the fertility plats have been tile drained and will be in better condition for future investigations. The demonstration farms have been taken over by the extension department, and the work at the substations is divided between the station and the extension department. Considerable work was done in a study of hogging off corn, breeding horses, the use of silage in summer, breeding potatoes, forage crops for pigs, the cost of producing milk, and a study of the carrying capacity of the range for steers. Several characters in potatoes were found to be hereditary. On the plats devoted to soil fertility attention was given chiefly to learning the most economical methods of maintaining the productive capacity of the soil. The soils of the State are being classified in connection with a soil survey. Some attention was also given to determining the amount and quality of manure produced by horses and to the problem of distribution of labor under different systems of farming. A large mass of data was accumulated in connection with the study of the cattle-breeding associations and dry-farming experiments.

The horticultural work of the station included a study of 180 strains of tomatoes, variety tests with cabbage, celery, sweet corn, onions, radish, lettuce, beets, and other crops; cultural studies with celery, cauliflower, asparagus, and strawberries, and tests of varieties of raspberries, grapes, and plums. It was learned that early tomatoes may best be grown by sowing the seed in a hotbed during the latter part of March and transplanting twice, finally growing the plants in tin cans or other containers until they are set in the field about May 20. A yield of 20 pounds of usable tomatoes per plant is considered satisfactory.

The following publications were received from this station during the year: Bulletins 108, Avian Tuberculosis; 109, Report of Four Years' Work of the North Dakota Holstein Cattle Breeding Circuit; 110, Dry-farming Investigations in Western North Dakota; 111, Tomatoes for North Dakota; Special Bulletins of Food Department, vol. 3, Nos. 3–17; Paint Bul. 1, Lessons from the 1906 Test Fence—North Dakota Paint Law and Its Benefits—Analyses of Mixed Paints—Method of Varnish Analysis; Circulars 1, Flax Cropping—Harvesting Methods; 2, Report of Progress in Sugar-beet Trials; 3, Preliminary Report on the Mammals of North Dakota; 4, Extermination of Ground Squirrels, Gophers, and Prairie Dogs in North Dakota; 5, The Farmer's Vegetable Garden; 6, Early and Late

Sowing of Flax—Growing Flax on Corn Ground—The Seed Field—Resistant Seed; and the Annual Reports for 1913 and 1914, parts 1 and 2.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	93,268.88
Miscellaneous	16,087.05
Total	139,355.93

More attention is being given to the administration of the station than was formerly the case, and the station appears to be well organized and efficiently directed. The plans now in operation contemplate the selection of a few definite topics of vital importance to the welfare of the State and the concentration of effort upon these problems.

OHIO.

Ohio Agricultural Experiment Station, *Wooster*.

C. E. Thorne, M. S. A., *Director*.

The work of the Ohio station covered a wide range of investigation and practical experiments during the year, and the station was successful and prosperous in all ways. The State legislature appropriated for the use of the station during the coming year about the same sum as was available during the past year. According to the State appropriation act the State fiscal year was changed to correspond with the Federal fiscal year, and specific provision was made for the salaries of most of the station staff, thus placing the staff essentially on a State statutory roll. The act also provides that hereafter the sale of products fund could not be used by the station, but must be covered into the treasury. A new dairy building (Pl. VII, fig. 1), was erected to replace the one destroyed by fire in 1913. It was constructed of red brick and has outside dimensions of 40 by 58 feet. The basement contains the creamery, cold-storage and receiving rooms, and a laboratory for milk testing. The dairy chemistry laboratory is on the first floor, and the bacteriological laboratory on the second floor. The building cost about $16,500 and contains an excellent equipment for cold storage.

Adams fund projects.—Decided progress was made in the project on the increase in fixation of desirable properties in cereals. A variety of wheat has gradually been developed from an original selection made in 1906 for stiffness of straw and for yield. This variety does not lodge under ordinary storm conditions and yields two bushels per acre more than the ordinary type from which it was developed. The stiffness of straw has been shown to be a fixed character not



FIG. 1.—NEW DAIRY BUILDING CONTAINING OFFICES AND LABORATORIES, OHIO STATION.



FIG. 2.—MAIN BUILDING SHOWING NEW ADDITION, OHIO STATION.

influenced by climatic or other conditions of environment. Variation in pure lines of wheat in regard to size of kernel, length of head, protein content, and tendency to tiller was the continued subject of study, but the observed variations were not inherited. Similarly with corn, the characters to which attention was hitherto given have failed to show evidence of being hereditary except the one of stiffness of stem. A strain has been developed which stands up much better than other strains under storm conditions.

The study of the mineral nutrition of animals progressed satisfactorily and yielded many interesting results. In one set of experiments pigs were fed a basal ration of ground corn, while the different lots received different proteins from milk, meat meal, soy beans, middlings, and linseed meal. Milk proved to be most efficient in producing growth and, in general, animal proteins were more efficient than cereal proteins. In the comparison of the physiological effects of different phosphorus compounds 120 pigs were maintained on a basal ration of hominy, wheat gluten, blood albumin, corn bran, agar, and salt. The phosphorus compounds used in the experiment were both organic and inorganic. At first it appeared that organic phosphates, especially glycero-phosphates, were more efficient than inorganic phosphates. Further studies, however, indicated that all phosphates are about equal in nutritive efficiency. It appeared to be unsafe to draw conclusions as to the nutritive value of phosphorus from the use of pure compounds. It was found that the proportions of calcium, magnesium, and phosphorus in bones tends to remain constant, but may be modified to a slight extent by the ration.

In continuing the study of the phosphorus supply of Ohio soils, analyses were made of a great variety of soils to show the content of phosphorus, and pot experiments were carried on to determine its availability. In these experiments soy beans, wheat, and clover were used. The amount of phosphorus in the soil studied in this experiment varied from 0.01 to 0.1 per cent. A high total phosphorus content was found to be correlated with a high content of humus and lime.

Interesting results were also brought out in the project on the effect of excess or deficiency of phosphorus in the soil upon the character of the plant. Wheat showed a corresponding increase in phosphorus and carbohydrate content and the lowering of the nitrogen content after fertilization with phosphorus. No such correlation was observed in corn and oats. It was found that inoculated soy beans absorb much more phosphorus than noninoculated plants. A study was therefore begun of the possibility of the formation of organic phosphorus from inorganic phosphorus in the nitrogen nodules.

The investigation of the sulphur requirements of crops involved the study of the growth and composition of plants on soil fertilized

with phosphates with and without the addition of calcium sulphate. In the case of rape calcium sulphate increased the yield and the protein content. Millet also showed pronounced effect from calcium sulphate. Tobacco showed a much smaller modification of the sulphur content from the addition of sulphates in the fertilizing material than of the chlorin content by the use of muriate of potash.

Encouraging progress was made on the projects on conditions affecting the physiology of the process of nitrification and the cytology of *Azotobacter chroococcum*. The methods employed in the study of the process of nitrification appeared to be somewhat defective and unreliable. Efforts were therefore made to refine and standardize these methods. In this work it became doubtful whether the usual determination of nitrates and ammonia is of as great value as has been supposed. Apparently, since nitrogenous substances are constantly undergoing changes, becoming either more or less complex, and since they exist under a great variety of forms, the determination of the nitrate and ammonia forms may be an inadequate index as to what is going on in the soil. In the soils of the experiment station the organisms which produce nitrification were found to be *Micrococcus nitrificans* and *Bacillus nitrificans*. In the study of the *Azotobacter chroococcum* a special effort is being made to determine whether this organism will fix atmospheric nitrogen in the presence of combined nitrogen. Considerable progress has been made in this difficult line of investigation, but final results can not yet be announced.

Work with Hatch and other funds.—In the field of dairy industry the work of the station included feeding experiments with dairy cows, such as a comparison of alfalfa and clover hay, a study of milk substitutes in calf rations, a comparison of wide, medium, and narrow rations for cows to determine the effect of these rations on the progeny of the cow, an inbreeding test with Holsteins and Jerseys, and cooperative work in the study of milk production. Data have been compiled from about 20 dairy farms for a period of five years on the cost of milk production, cost of raising cows, yield of milk, and other matters connected with the economics of dairying.

From the large list of experiments carried on by the agronomy department, mention is made of the following: A comparison of different rates of seeding alfalfa and clover, tests of different varieties and pedigreed strains of corn in the series of tenth-acre plats, a study of the relation of various visible characters in the ear and stalk of corn to the yield, variety tests with field peas, grasses, oats, soy beans, and wheat, a study of various systems of rotation, a comparison of results from different depths of plowing, the use of dynamite in preparing soils for alfalfa, and a study of continuous cropping with cereals and other field crops. From a comparison of the 5-year rota-

tion system with the continuous growing of corn it appeared that rotation gives an increase of 13 to nearly 15 bushels per acre over the yield from continuous culture. A comparison of ears, varying 2½ inches in length showed a difference in yield of only 1⅓ bushels per acre as a 10-year average.

An attempt was being made to determine the particular crop in the rotation which should receive stable manure. In the rotation experiment in which this study was made it has been found that $2.60 expended in phosphates for a five-year rotation yielded a net profit of $14, while nitrogen and potash caused an actual financial loss.

The chemistry department was cooperating with the agronomy department in a study of lime, particularly as to the determination of the duration or persistence of lime carbonate in the soil, the depth of soil affected by the application of lime, and the chemical changes of lime in the soil. Magnesian and nonmagnesian limestone proved to be equal in efficiency, while dolomitic limestone persisted longer than the nonmagnesian lime. The chemical department also made numerous miscellaneous analyses for other departments, particularly the departments of animal husbandry, agronomy, and horticulture. A study of the influence of fertilizers on the composition and quality of tobacco brought out a number of interesting points. The composition of the tobacco was modified to a considerable extent by different fertilizer treatments. For example, the addition of lime to the soil diminished the calcium and increased the magnesium content of tobacco. Tobacco from the limed plats was found to contain less phosphorus, potash, and sulphur than that from the unlimed plats. Acid phosphate when used in combination with muriate of potash increased the chlorin content, while nitrate of soda diminished it.

The work of the horticultural department covered a wide range of subjects. Nitrate of soda applied to apple trees on poor soil gave results quite equal to those obtained from a complete fertilizer. On the general-rotation plats of the station the prevalent deficiency of phosphorus in Ohio soils was strikingly illustrated in the growth of potatoes. In work with the currant it was found that the varieties catalogued by commercial nurseries are so variable and unreliable that they can not be accurately described. A study has been begun of the varieties of currants with the expectation of preparing a monograph on this subject in the near future. Fertility experiments were carried on with strawberries, raspberries, tomatoes, and apples. An attempt is being made to secure tomatoes resistant to wilt and apples resistant to fire blight. It was found that in greenhouses lettuce can be grown continuously on unrenewed soils to which manure is added.

In the department of animal husbandry attention was devoted chiefly to selection of hens for high egg yield, a comparison of range and confinement for poultry, a comparison of low and high protein

rations for laying hens, the cost of production of baby beef, a comparison of wide, medium, and narrow rations in their effect on the growth of ewes and lambs, and on the yield of wool, a comparison of corn and oats for young mares, a comparative test of breeds of pigs, breeding experiments with sheep, and a study of the life history of animal parasites, particularly ox-warble fly, thorn-headed worms of hogs, and ascaris worms.

In breeding experiments with sheep 3 groups of ewes, including 108 animals in all, were placed in pastures with one ram in each group. In one group the lambs produced on an average 1 pound of wool more than in the other groups. When the ewes were studied from the standpoint of possible inheritance of high wool yield from mother to offspring it was found that lambs from the high-shearing ewes produced three-fourths of a pound more wool than lambs from low-shearing ewes.

In fattening roasters and capons it appeared that a ration in which the amount of protein was constantly diminished gave poor results as compared to one in which the protein remained constant. Capons confined in small pens from the beginning of the feeding period gained 17 per cent less in weight than the capons allowed free range for the first 12 weeks of the feeding period.

The forestry work of the station included a number of special lines of study. The results of the long-continued tests of various kinds of wood for fence posts indicated the superiority of osage orange for this purpose. Incidentally records were obtained from osage-orange posts 45 years old which were still in sound condition. It has been found that white-pine seedlings grown without shade were decidedly more vigorous than those grown under shade. Experiments indicated that formalin used at the rate of 2 quarts of 1 per cent solution to the square foot prevented fusarium blight on young white-pine seedlings. Many private, municipal, and State institutions have adopted scientific forestry methods and are cooperating in experiments with the station. A special appropriation of $10,000 was obtained for the purchase of land in the southern part of the State for forestry work under the supervision of the station.

The station carried on its farm-management work quite largely in connection with the county farms, each of which receives $2,000 from the county. On one of these farms an attempt was made to determine the cost of various systems of rotation. On the Hamilton County farm a study of the cost of milk production was carried on. Other lines of work included an attempt to determine the cost of pork production, a comparison of economic returns on farms of different sizes, the economy of grain and stock farming, and comparative economy of pasturing and soiling, of horse and man labor, and of manure and cover crops as a source of humus.

The major project of the entomological department for the year was concerned with the relation of insect pests to plant diseases, especially fire blight, peach yellows, and cucumber wilt. It was shown that the fire-blight organism may live in honey for at least four days and that bees are agents in the transmission of the disease. The organism may also live in honeydew for at least two days. Several species of insects have been shown to be directly concerned in the transmission of this disease. Attention was also given to the study of plant lice in orchards, the habits of the second brood of codling moth, economics of orchard spraying, the life history of the clover leaf-roller, the study of scale insects, grapeberry worm, wood borers, nut weevils, greenhouse insects, and bark beetles.

The work of the department of plant pathology and botany involved seed testing in conformity with the seed law, seed identification, general studies of plant diseases, and tobacco breeding. Special attention was given to diseases of forest trees, particularly chestnut blight and oak-twig disease, and to the diseases of potatoes. An effort was also made, in cooperation with the entomological department, to work out the relationship between insects and the prevalence of fire blight. Progress was made in a study of neck-rot of onions, cucumber wilt, and the diseases of forage crops and greenhouse plants.

The following publications were received from this station during the year: Bulletins 259, Ohio Weather for 1912; 264, Orchard Bark Beetles and Pinhole Borers; 265, The Cob Rot of Corn; 266, Labor Cost of Producing Corn in Ohio; 267, The Value of Soy Bean and Alfalfa Hay in Milk Production; 268, Substitutes for Corn in Rations for Fattening Swine; 270, Experiments in Winter Lamb Production—I, Rations for Ewes and Lambs—II, Cost of Production; 275, The Clermont County Experiment Farm; 276, Report of the Forester; 277, Ohio Weather for 1913; 278, Thirty-third Annual Report,1914—Press Bulletins—Index; 279, The Maintenance of Fertility—Liming the Land; 280, Some Important Animal Parasites Affecting Ohio Live Stock; 281, Summer Treatment of Greenhouse Soil; 282, Corn Experiments; 283, Specific Effects of Rations on the Development of Swine; 284, Rations for Growing and Fattening Roasters and Capons; Technical Bulletins, 5, A Review of the Literature of Phosphorus Compounds in Animal Metabolism; 7, On Nitrification, Preliminary Observations; Circulars, 141, Rural Cooperation and Cooperative Marketing in Ohio, 1913; 146, The Loess Soils of Southwestern Ohio; 147, The Cost of Tile Drainage; 148, Spraying Farm Orchards by the Club Plan; 149, Spraying Program for Orchards with Combinations Recommended; 150, Tree Fillings and Wound Dressings for Orchard and Shade Trees; 151, Methods of Soil Sterilization for Plant

Beds and Greenhouses; 152, A Metabolism Crate for Swine; and 153, Mushrooms—Edible and Poisonous.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	97,550.08
Farm products	30,152.56
Miscellaneous, including balances	185,613.61
Total	343,316.25

The work of the Ohio station as a whole progressed without interruption and yielded satisfactory results in all departments of investigation. The rotation and other plat experiments on the station farm are arranged and organized in a manner which promises results of great importance. The branch stations serve as a means of extending the work to various typical sections of the State.

OKLAHOMA.

Oklahoma Agricultural Experiment Station, *Stillwater.*

W. L. Carlyle, M. S., *Director.*

Conditions at the Oklahoma station remained somewhat unsettled during the first part of the year, but in December Prof. W. L. Carlyle was elected director and clothed with powers to administer the work and funds. The Federal funds, which had been temporarily withheld, were restored to the station. Morrill Hall, the agricultural and administration building, was completely destroyed by fire. In this fire the stock of station bulletins, the station library, mailing lists, much apparatus, and many of the scientific records were lost. Several changes occurred in the staff of the station. A. F. Rolf, head of the poultry department, and R. C. Potts, professor of dairy husbandry, resigned. M. A. Beeson was appointed agronomist vice O. O. Churchill, resigned. The numerous changes in the staff brought about corresponding changes in the conduct of the research work of the station, resulting in several instances in temporary interruptions of this work.

Adams fund projects.—The project on sheep breeding for the purpose of establishing a breed suitable for winter lambing was continued actively. The records were carefully examined and compiled, and an extensive series of observations was begun on the weight of lambs at birth, at successive periods, the conformation of the body, folding and other characters of the fleece, wrinkling of the horns, prolificacy, and other points. Samples of the wool were taken for preservation, and scouring tests were made. Attention is being given to the determination of unit characters to be studied in future progeny. During the year 66 lambs were under observation.

In breeding Kafir corn and sorghums for drought resistance progress was somewhat slow during the year. The season was dry, and a number of unfortunate accidents occurred with the material. Selections were made from 150 rows of Kafir corn grown in triplicate and therefore representing 50 different strains.

The investigation on the chemistry of grain sorghums was actively pursued and led to some interesting results. The chemical and physical constants of the fat of feterita were determined. Fats were isolated from several varieties of Kafir corn. The consistency of the fat appeared to depend on the age of the seed or the length of time it had been in storage.

The study of the composition and properties of silage made from grain sorghums was continued by means of laboratory work. The investigation included a study of organic acids, alcohols, and other constituents of silage in brick, hollow tile, and steel silos. The acid in the silage was found to be chiefly acetic, and no aldehydes or alcohols were detected. Some attention was also given to a study of the chemical action of silage on metals and other materials used in constructing silos.

The effect of cottonseed meal and other highly nitrogenous feeds upon breeding stock was studied in connection with chickens and rats. The study of the effect of cottonseed meal upon hogs was finished during the previous year, and the results obtained with chickens and rats were compared with those secured with pigs. It appeared that rats could endure an extremely narrow ration continuously for a long time. Little effect was noticed on the fertility of rats, except that the females did not live long after the birth of the young. With poultry the work was largely a comparison of cottonseed meal and beef scrap. A larger degree of fertility was obtained by means of cottonseed meal.

On account of the numerous changes in the staff and rearrangement of work due to resignations the projects on artificial impregnation and on the physiological activities of soil bacteria under different conditions received little or no attention.

Studies were continued on the setting of the fruit of the tomato. An experiment was planned for spraying tomato plants for the purpose of killing the minute insects on pollen, and also to cross the tomato with native species of Solanum. The project on the effect of cultural operations and fertilizers in modifying the development of fruit buds and their resistance to extreme cold was badly handicapped by the destruction of the records in the fire in the administration building. The study of grafting to determine whether the limiting factors of the process are to be found in sap was continued somewhat actively. Numerous samples of wood were taken at the graft union for future examination.

Considerable attention was given to a study of the corn plant louse. The summer forms of this insect have been thoroughly studied, but it has not yet been determined how or where it passes the winter. Similarly with the cowpea louse the life history during the summer has been rather thoroughly determined, but the habits and life history of the winter forms remain to be elucidated. The life history of the chicken flea was rather thoroughly worked out, but the records were destroyed by fire, and some of the observations must be repeated.

Work with Hatch and other funds.—The department of animal husbandry carried on a feeding experiment with pigs in which corn, Kafir, and various other feeding stuffs were used. In another test corn and shorts were fed to pigs with or without bone meal for the purpose of determining the effect of these rations on the breaking strength of bones. A comparison of alfalfa hay and cottonseed meal as the protein supply of lambs was made with better results from the alfalfa hay. Considerable work was done in fitting up the poultry houses for experimental work which it is hoped to carry on during the year. Some of the miscellaneous observations and simple experiments carried on with poultry were published in bulletin form. The animal husbandry department also made a series of tests and general observations on silos constructed with different materials and published a bulletin on that subject.

In the agronomy department quite a variety of work was carried on with the support of Hatch and other funds. This work included experiments in the continuous culture of wheat, variety tests of corn, legumes, sorghums, and sweet clover, fertility experiments with alfalfa, including a comparison of results from plowing at depths of 5, 10, and 15 inches. Some results were also begun in cotton breeding, soil management, particularly with reference to subsoiling, tests of upland alfalfa, and meadow grass in the prevention of soil erosion, and experiments to determine the proper rate and date of seeding Sudan grass and sweet clover. The miscellaneous experiments and observations of the agronomy department on Sudan grass, cowpeas, and grain sorghums were published as bulletins of the station.

The chemical department made numerous miscellaneous analyses of fertilizers, feeds, and other material. Analytical work was also done on cottonseed meal and on crude-fiber determinations. Considerable time was taken for analyses done in cooperation with the other departments of the station, particularly the analysis of feeds in experiments with the animal-husbandry department and analyses of sweet potatoes in connection with the cold-storage experiments of the horticultural department.

The veterinary department carried on some work with reference to the immunity of hog-cholera complement fixation and the effect of various chemical agents upon hog-cholera virus. It was found that the general effect of the progress of hog cholera in an infected hog is to reduce the red blood corpuscles and the hemoglobin content of the blood and also to lower the count of the white blood corpuscles. The introduction of virus into healthy hogs lessens decidedly the count of the red blood corpuscles, but does not affect so greatly the count of the white corpuscles.

The horticultural work of this station during the year included the planting of a number of grapes and small fruits of different varieties, thus increasing the experimental orchard; a comparison of results obtained from the use of 1-year-old and 3-year-old apple trees for planting purposes; and experiments in methods of grafting superior varieties of pecans on native trees.

The State legislature passed a law providing for carrying on nursery inspection by the State board of agriculture. This should relieve the station entomologist of much routine work. Experiments were continued with different breeds of bees, and a rather large assortment of honey plants was planted for use in this experiment. The miscellaneous entomological work included studies on the life history of the false chinch bug, alfalfa webworm, and locust-tree borer.

The following publications were received from this station during the year: Bulletins 101, Silos in Oklahoma; 102, The Grain Sorghums; 103, Sudan Grass; 104, Hog Cholera; 105, Cowpea Culture; Circulars 30, Preliminary Report of Vitality and Activity of Sperm Cells and Artificial Insemination of the Chicken; 31, The Cowpea Weevil; 32, Seeding Wheat in Oklahoma; 33, Four Cheap Silos; 34, Forage and Silage Crops for Oklahoma; and 35, Kafir Score Card.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	5,000.00
Farm products, including balance from previous year	4,382.48
Total	39,382.48

Oklahoma station has passed through a trying period, but the stand taken by the department has resulted in securing for it a recognition of the need of proper administration and freedom from interference in the proper use of its funds and the direction of its work.

Despite the fact that many new men of limited experience were brought into the station, the general conditions have greatly improved. The State showed generosity in its increased financial support, and with the constructive plan of work there seems to be a good outlook for the strong and efficient development of the station.

OREGON.

Oregon Agricultural Experiment Station, *Corvallis.*

A. B. Cordley, M. S., *Director.*

The work of the Oregon station progressed satisfactorily during the year, but the work of the future is somewhat handicapped by failure to receive State appropriations and by the consequent shortage of funds. The State legislature failed to appropriate any station funds except for the substations. This was especially discouraging in view of the excellent use the station has been making of its resources. This necessitated dropping several assistants from the station roll at the close of the year, which will interfere more or less seriously with the station work. It is confidently believed, however, that adequate appropriations will be provided at the next session of the legislature. A number of research students were employed on half-time for investigational work. The botanist and the entomologist left soon after the close of the year.

Adams fund projects.—The study of conditions affecting the pollination of the apple was carried forward actively. The work of the year was done entirely in the laboratory and was concerned largely with an attempt to gain information on the cause of fertility and self-sterility. Apples and pears have been grouped according to their response to various forms of pollination. In connection with this work a study was made of the development of fruit buds. The growing point of the twig appears to be a structure which must be regarded as potentially either a leaf bud or a fruit bud. Distinct leaf buds, easily recognized as such, were found as early as May.

The project on the irrigation of apples and pears was continued, largely in the greenhouse, dwarf Bartlett pears being used for the experiment. In this work 4 lots of 12 trees each receive measured quantities of water, as required, applied in a different manner for each lot. Careful records are made of the growth in length and diameter, of the quantity and character of the fruit, and on other points. Some definite information has already been secured on the effect of water on the life of the trees, the stage at which growth begins, and on the number of blossoms and character of fruit.

For use in the project on pruning as a factor in bud formation and differentiation a block of 4 acres of apples, including about 2,000 trees, are being grown, and 1,200 trees representing 8 varieties were planted during the year. Photographic records are made of the trees, and the pruning work is carried on in relation to the branch rather than to the whole tree.

In the study of critical temperatures of leading orchard fruits the work was conducted largely with Bartlett pears, with especial refer-

ence to injury to pollen by low temperatures. Some of the results were lost in consequence of an unusually late frost. A large series of inoculations was made in the further study of apple anthracnose. The work which remains to be done in this project consists largely of spraying experiments to determine the conditions under which the disease may be controlled.

Gummosis of the cherry was studied by means of numerous inoculations and observations on the development of the diseased areas. An attempt is being made to determine whether any enzym is specifically connected with the development. Gummosis appears to be a bacterial disease. Two distinct forms of bacterial organisms have been isolated. The canker is believed to be the same disease which appears on several other fruit trees, as well as on the cherry. The study of lupulin and other active principles of hops was in abeyance during the year, but it is likely that the work will be taken up and completed during the coming year. Attention will be given largely to an investigation of hop seed.

The study of the incubation of hens' eggs was one of the leading lines of investigation for the year. This problem was attacked from the biochemic standpoint, the eggs being followed through all the embryonic stages. It was found that at the time of hatching a small portion of unabsorbed yolk remained. This unabsorbed yolk and the young chick were separately analyzed with reference to the content of ash, protein, fat, and other constituents. In the tissues of the young chick the amino acids obtained from the hydrolysis of the protein were determined. It was found that the moisture of the incubator has an effect on the absorption of the yolk, particularly in increasing metabolism. This factor appears to be more important than that of carbon dioxid.

A distinct advance was made in the chemical investigation of spray material. A reliable method was devised for the preparation of pure lead hydrogen arsenate. In this work also a new basic lead arsenate of apparently constant composition was obtained. In a series of field tests pure arsenates, used at strength as high as 8 pounds to 100 gallons of water, caused no injury to foliage. In the case of tent caterpillars the acid salt was found to have the most active poisonous effect.

Work on the study of the activities of soil bacteria was carried forward. A number of strains of Azotobacter were isolated, and the nitrogen-fixing power of these strains was compared. The types of soil on which these studies were made varied in reaction from very acid to alkali. Lime showed no effect on the number of bacteria except in acid soils. A direct correlation was observed between the quantities of ammonia formed and the number of bacteria. The ammonifying powers of the soil appeared to vary greatly. The light

soils produced the greatest amounts of ammonia from added nitrogenous substances.

A survey of one of the National Forests was made in studying the life history of the bark beetles which affect the Douglas fir. Much valuable material was collected in this survey, as well as in visits to a burnt tract of another forest. The material collected and the observations thus far made are considered as forming a basis for an understanding of the life history of these pests.

Work with Hatch and other funds.—A large amount of important work was done in poultry breeding and on other problems connected with the production of poultry. It was rather definitely shown that egg-laying qualities may be inherited. In breeding experiments involving the use of the best and the poorest layers it was found that both of these qualities could be perpetuated. The egg-laying quality appears to depend in inheritance to some extent upon the male, but this character seems not to be sex limited. This work was done with Barred Plymouth Rocks. Other experiments were carried on with crosses between White Plymouth Rocks and White Leghorns. A larger egg yield was obtained from the hybrids than from the pure-bred fowls. Correlation appears to exist between the weight of the hen and egg production, the heavier hens of the breed being generally the poorest layers.

The horticultural work of the station was of exceptional value and extent. This work covers a wide range of practical experiment and scientific investigation, in addition to the several Adams fund projects in horticulture. Among the lines of study carried on during the year mention should be made of cultural experiments with grapes, general observations on windbreaks, hedges, and ornamentals for sandy soils of eastern Oregon, a study of the segregation of characters in the Le Conte pear, and experiments on the cooking qualities of apples. The horticultural work is carried on partly at the main station and partly at Medford, Hood River Valley, Hermiston, and various other localities in the State. In the Hood River Valley it was found that nitrate of soda not only increases the size of the fruit and the vigor of the tree, but gives a fourfold yield. At Hermiston a number of experiments are under way in testing legumes and other cover crops for orchards.

An extensive study was made of orchard economics, as based on detailed records obtained from 1,000 orchards located in British Columbia, Washington, and Oregon. Breeding experiments with strawberries, cherries, prunes, loganberries, nuts, and cover crop are also in progress, as well as fertilizer experiments with prunes, onions, beans, and other garden vegetables. In comparing the cooking qualities of apples it was found that the size of the fruit has little effect upon the quality of apples for making sauce, but that fruits

are best for sauce when at their prime or a little overripe. The flavor and texture of apple jelly appears to depend upon the chemical composition of the apple rather than upon its texture.

The chemical department carried on experiments in spraying elemental sulphur on legumes, and also various phosphates free from sulphur. Gypsum, ferrous sulphate, rock phosphate, and other phosphate materials were also applied to alfalfa, clover, and vetch. Wherever sulphur was applied there was a decided increase in yield, in some cases as much as 500 per cent. The experiments indicate a sulphur deficiency in the soils of south Oregon, and analyses of these soils showed a very low sulphur content. Gypsum gave better results than elemental sulphur, and ferrous sulphate was also beneficial. Analysis of beaver-dam soils used for onions showed them to be especially rich in potash. The chemical department also devised simple and accurate methods for the determination of the composition of the polysulphids and of the amount of calcium hydroxid in lime-sulphur.

In the field of agronomy and soils a large amount of experimental work was carried on. Some of this work was done at the dry-farming stations, where special growing conditions have to be met. At Corvallis an effort is being made to develop rations of forage and silage which will carry cows on green feed throughout the year. Much work was also done in breeding corn, oats, barley, potatoes, and other field crops. A study of flax for seed and fiber has been under way for two years. Rotation experiments designed to throw light on the question of soil fertility have been continued, and a large mass of data has been collected in connection with this work.

In the study of irrigation and soil moisture in western Oregon it was found that evaporation from a water surface, from April 30 to October 1, averages about 24 inches at Corvallis, while the average rainfall for this period is 5.52 inches. The most economical increase of alfalfa from irrigation was obtained from the use of 4 inches of water in wet seasons and 6 inches in dry seasons. The corresponding amounts for potatoes were 2 and 4 inches, respectively. In addition to these experiments and observations a large amount of work was done in connection with cultural methods and the use of fertilizers for various farm crops, and on the value of green manures.

The dairy department conducted feeding experiments with alfalfa-molasses meal as a substitute for mixed grain rations for cows. Experiments were begun on the problem of the influence of the extract of pineal gland on milk secretion. Distinctly beneficial effects in reducing the bacterial content of milk were obtained from clipping the udder. Kale appeared to keep up the milk flow better than silage. The objection to kale is that it gives an unpleasant flavor to

the milk if fed shortly before milking. Comparative feeding experiments were also made with calves, using skim milk and mixed and prepared feeds.

The veterinary work of the station included a study of the agglutination method for the detection of white diarrhea in poultry, and of the tuberculin test as applied to poultry. The method was found to be of decided value. Some work was also done on granular vaginitis.

The entomological department carried on studies in the life history of a large number of injurious insects. Experiments were also made with the insecticides for the control of slugs. In this work poison dust sprays and poison baits gave good results. Some attention was given to cabbage root-maggot, strawberry root-borer, spotted cucumber beetle, and other pests.

An elaborate investigation was made of the life history, habits, and means of combating the common red spider. Among the measures suggested for the efficient control of this pest are the destruction of the useless host plants, clean culture, a suitable crop rotation, and, under certain conditions, the free use of a water spray.

Some investigations were carried on with reference to potato diseases, particularly fusarium disease, late blight, and powdery scab, apparently reported for the first time west of the Rocky Mountains. Attention was also given to the brown rot of prunes and a bacterial disease of filberts.

In the department of animal industry experiments were carried on in feeding pigs and beef cattle. Detailed records were taken of the cost at different stages of growth and during the fattening period. Comparative tests were made of tankage with skim milk, and buttermilk used with barley. The beef-feeding experiments were carried on chiefly in eastern Oregon. Alfalfa hay gave much better results than prairie hay or barley hay. Some work was also done in determining the cost of production and handling of sheep.

The following publications were received from this station during the year: Bulletins 117, Loganberry By-products; 118, Ammonification and Nitrification Studies of Certain Types of Oregon Soils; 119, A Report of the Experimental and Demonstration Work on the Substation Farms at Moro, Burns, Redmond, and Metolius.—I, Tillage and Cropping Methods; 120, Improving Sandy Soils by the Use of Green Manure Crops; 121, The Common Red Spider, or Spider Mite; 122, Irrigation and Soil-moisture Investigations in Western Oregon; 123, An Inquiry into the Nature of a Somatic Segregation of Characters in the LeConte Pear; 124, Comparative Cooking Qualities of Some of the Common Varieties of Apples Grown in Oregon; 125, Windbreaks, Hedges, and Ornamentals for Irrigated Sandy Soil of Eastern Oregon; 126, Grape Culture, With Special Reference to Commercial Production under Irrigation in Eastern Oregon; Research

Bulletin 3, A Report of Chemical Investigations on the Lime-sulphur Spray; Biennial Report, 1913–14; Biennial Crop Pest and Horticultural Report, 1913–14; Reports Eastern Oregon Branch Experiment Station, 1911–12 and 1913–14; and Report Eastern Oregon Dry Farming Branch Experiment Station, Moro, 1913–14.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	81,295.28
Farm products	140.94
Miscellaneous, including balance	15,285.58
Total	126,721.80

The Oregon station occupies a strong position in the State by virtue of its well-developed experiments at the branch stations and its conspicuous scientific investigations along a number of lines. The station has a strong and enthusiastic following, and it is to be hoped that adequate State provision of funds will be forthcoming to enable it to maintain the position it has attained.

PENNSYLVANIA.

The Pennsylvania State College Agricultural Experiment Station, *State College.*

R. L. Watts, B. Agr., M. S., *Director.*

The activities of the Pennsylvania station, although already quite numerous, were increased by a number of lines of work entered upon during the year. The principal changes on the staff were the appointment of M. G. Kains as horticulturist and of J. M. Sherman as bacteriologist. In addition a number of appointments and resignations in the minor positions took place. The completion of the new dairy barn (Pl. VIII, figs. 1 and 2) greatly extended the equipment of the dairy-husbandry department by providing room for a larger herd and for increased experimental work.

Adams fund projects.—The pomological investigations on factors influencing the yield and quality of apples and peaches were conducted during the past year in the usual series of field experiments, mainly with reference to the influence of fertilizers and cultural methods on the yield and quality of apples. As incidental results may be mentioned the finding that apple trees with a hoed crop like potatoes grown between the rows made a much better growth than trees in ground plowed early and sown to cover crops and that trees mulched with alfalfa grew better than those given cultivation. The contemplated chemical and physiological studies in connection with this project were not entered upon during the year.

The work on the long-time fertilizer plats was conducted in accordance with the original plan. During the year a large number of soil samples were taken for analysis. It was found that in the most acid soil of the ammonium sulphate plats nitrification was still active. Oats showed themselves quite resistant to soil acidity. Grown on these plats since 1881, the effect of acidity was first observed in 1913, and in 1914 they failed completely where the acidity was highest. It was further shown that timothy proved more resistant than clover and that where corn fails as a result of acidity there appears a marked accumulation of water-soluble nitrates. The fertilizer phase of this project seems to have been quite well covered, and preparations were made to enter more fully upon the comparative chemical studies.

Only limited progress was reported in the study of the bacterial flora of certain of the general fertilizer plats. Bacterial counts were made in soil samples from some of the plats, but no species were determined. Experiments conducted to throw light upon ammonification have not given conclusive results. The study of the effects of calcium and magnesium carbonates and oxids on nitrification was in abeyance during the year.

As in previous years, the Adams fund work in animal husbandry was confined to the Institute of Animal Nutrition. A special feature was made of work on the net energy values of red-clover hay and maize meal, and the project was brought to a close. A study of the influence of condition on the metabolism of cattle was also completed during the year, but the results have not yet been published. An investigation of alkali excretion in the urine of a steer had special reference to the ash balance and the forms of nitrogen present.

Work with Hatch and other funds.—A large number of experiments, representing a wide range of problems, were conducted with Hatch and other funds. In agronomy variety tests were made with wheat, oats, potatoes, barley, soy beans, and alfalfa, and breeding experiments were carried on with a number of these crops, together with corn and several species of grasses. Trials were also under way to test the value of different substances, such as land plaster, lime, ammonium sulphate, cyanamid, Thomas slag, and barnyard and green manure in growing different crops, including pasture, as well as for different types of soil and systems of soil management and crop rotation. Attention was further given among other things to matters pertaining to farm management, methods of determining soil acidity, leaching as related to acid soils, the culture and use of sweet clover, and the application of limestone in different degrees of fineness. The results with sweet clover planted on abandoned farm land either in pots or in the field indicated that phosphorus and calcium were the elements most necessary for its successful growth. Similar results



FIG. 1.—NEW DAIRY BARN, GENERAL VIEW, PENNSYLVANIA COLLEGE AND STATION.



FIG. 2.—NEW DAIRY BARN, SHOWING FENCES WITH CONCRETE POSTS, WATER TANK, AND MACADAMIZED YARD, PENNSYLVANIA COLLEGE AND STATION.

were secured on virgin cut-over land, and it was further indicated that on these lands pastures may be established by the use of lime, phosphorus, and such leguminous crops as clover, sweet clover, and alfalfa. The outcome of certain experiments with pulverized limestone again showed that material coarser than that which will pass through a sieve 60 meshes to the linear inch has comparatively little effect upon the growth of plants. Dolomitic limestone proved to be equally as good as pure calcium limestone in promoting the growth of plants on acid soils.

The department of animal husbandry carried on experiments in fattening grade draft horses, steers, pigs, and poultry, and studied maintenance rations for breeding flocks of mutton and wool sheep, beef-type breeding cows, brood sows, and farm work horses. Beef scrap was compared with skim milk as a source of animal food in fattening rations for poultry, and the cost of different methods of feeding hogs and producing pigs received attention. A study was also made of some physical and chemical variations in corn silage at various depths in the silo. Silage alone was found unsatisfactory as a maintenance ration for mutton and wool ewes, but when fed with alfalfa it gave good results. The measurement of steers, including 25 different body measurements, was begun with a view to establishing possible correlations, and measurements were also made of calves to obtain a growth curve.

The botanist studied collar rot of the apple, winter blight or spring disease of tomatoes, blister rust of conifers, control of clubroot, the inheritance of color and form of flowers of *Phlox drummondii* and of color in flowers of *Mirabilis jalapa*, sterility in Nicotiana hybrids, and the use of asphaltum as a dressing for cuts and wounds on fruit trees. General observations also were made on the course of the apple-rust disease. The study of sterility of Nicotiana hybrids was conducted in cooperation with the Bussey Institution. The results of the study on the collar rot of apples were prepared for publication.

The dairy department continued its work on keeping dairy cows in open sheds as compared with keeping them in dark and poorly ventilated and well-lighted and well-ventilated barns. Digestion trials were made with calves to ascertain the optimum protein ratio in feeding from birth to the period of highest production. Different kinds of bedding materials for dairy cows when kept in stanchions, box stalls, or open sheds were tested, and silage preservation in tile, cement, and wooden silos was studied, together with the development of lactic and acetic acids in the ensiling process. Different feeds in their relation to veal production, and various feeding methods, including the Holland or dark-stall method, were compared, and observations on the growth of dairy animals were made. Milk records were kept to determine the cost of production, and data were gath-

ered as to the desirability of using the clarifier and the suitability of different types of cans for shipping milk and cream. Studies were also conducted on laboratory methods for counting bacteria in milk and for determining the amount of acid in media.

The work in experimental agricultural chemistry comprised studies of a chemical and physical character of the land on which the general fertilizer plats are located and of the behavior and effect of coarse limestone particles on one of these plats, together with various investigations on the culture, improvement, and composition of tobacco. Tests were carried on with varieties of cigar-leaf tobacco, new Connecticut seed-leaf hybrids, four of the most promising strains of Pennsylvania broad leaf, and local strains of Pennsylvania Havana and broad-leaf tobacco. Studies were also made to determine the value of manure alone as compared with the use of manure supplemented with acid phosphate and potash, and to ascertain the variability in nicotin content of three strains of Texas cigar-leaf tobacco when grown in Pennsylvania. The value of high and low topping and normal and close planting of tobacco also received attention. Work with tobacco carried on under a special appropriation in Lancaster and Clinton Counties showed that the use of muriate fertilizers on certain forms had produced an ash high in chlorin and that the high ratio of chlorin to potash was responsible for the reduction in the burning qualities of the tobacco grown.

In addition to his Adams fund work the pomologist carried on apple-orchard experiments, culture and fertilizer tests with apples and peaches, and a test of methods of controlling borers in apple and peach trees, and made observations on the relation of fertilizer to the so-called tan-bark disease of apples, and the influence of dynamiting on soils intended for orchard planting.

The efforts of the horticultural department were centered mainly on work with cabbage, tomatoes, asparagus, and rhubarb. Variety tests with cabbage and studies of the root development of seedlings on different soils were carried on, together with cultural tests, mainly on the distance between plants in rows, and selection experiments with about 25 different strains. In addition to testing a number of varieties of tomatoes studies were made of Mendelian inheritance in tomato crosses. Attention was given to the value of grading the crowns of asparagus at the time of planting and to the effect of subsoiling and manuring when the planting is made. Selection for disease resistance in tomatoes was carried on, and the influence of the size of seed from the same plant was studied. With rhubarb selection experiments were made to secure an improved type.

The activities of the forestry department included experiments in the treatment of fence posts to increase durability, forest-nursery practice, woodlot management, and reforestation and forest plant-

ings. Experiments in basket-willow production were pursued in cooperation with the Forest Service. Determinations were made of the moisture content of different woods under various conditions and of the adaptability of the different species for special purposes. The lasting qualities of western red-cedar shingles when nailed with different kinds and numbers of nails were noted, and field observations in forestry were made, together with certain phenological observations.

The following publications were received from this station during the year: Bulletins 131, The Use of Lime on Land; 132, The Soils of Pennsylvania; 133, Steer Feeding Experiments; 134, Experimental Results in Young Orchards in Pennsylvania, and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, balance from previous year	2,979.77
Fees	15,627.00
Farm products	44,884.26
Total	93,491.03

The problems studied by the Pennsylvania station relate to the various phases of agriculture practiced in the State, and consequently have a wide range. Investigations technical in character as well as questions whose more immediate solution is demanded by the agricultural industries continue to receive attention.

The Pennsylvania State College Institute of Animal Nutrition, *State College.*

H. P. Armsby, Ph. D., LL. D., *Director.*

The past year's work of the Institute of Animal Nutrition was carried forward steadily along the same general lines as in previous years, but at the close of the year an arrangement was entered into with the Bureau of Animal Industry of the Department of Agriculture by which the cooperative investigations beginning with the year 1915–16 will have special reference to some of the fundamental problems of the nutrition of dairy animals in place of the investigations hitherto made upon beef animals. There was no material increase in appropriation or equipment.

The principal experimental work during the year 1914–15 consisted in further tests with the respiration calorimeter of some earlier results regarding the net energy values of red-clover hay and corn meal already referred to above. In addition a study was made of the methods of preserving urine of animals to forestall chemical changes before the actual laboratory work is performed.

A report upon the results of the investigations up to July 1, 1912, in their bearings upon the net energy values of feeding stuffs was

published during the year in the Journal of Agricultural Research, volume 3, page 435. The experiments described took into consideration the losses of chemical energy, the expenditure of energy consequent upon feed consumption and its factors, and the net energy values and their computation. The report included the results of 76 different experiments with the respiration calorimeter upon 9 different animals, which led to the formulation of a new and simpler method of estimating the net energy values of feeding stuffs from their digestible nutrients.

It was also shown that the energy expended in the consumption of feed commonly spoken of as "the work of digestion" is due only in part to the mechanical work of masticating and handling the feed and that a larger factor in it is the specific stimulating effect of different feeding stuffs upon the metabolism of the animal. The average energy expenditure consequent upon the consumption of 1 kilogram of dry matter was worked out and reported for 11 different feeding stuffs, and the average net energy values obtained in the experiments for the 11 different feeding stuffs in question were also summarized and recorded.

A paper on the methods of drying urine for analysis was published in the Journal of Biological Chemistry, volume 19, page 105. Upon request the director prepared a paper upon the scope and methods of investigation in animal nutrition for the meeting of the Section of Agriculture of the American Association for the Advancement of Science at its meeting in San Francisco.

The institute did not publish any of its results in the regular series of station bulletins during the past year.

The Institute of Animal Nutrition maintains a high standard of research work, and the results obtained have an important application to the theory of nutrition as well as offering suggestions of importance to the farmer and feeder.

PORTO RICO.

Porto Rico Agricultural Experiment Station, *Mayaguez.*

D. W. May, M. Agr., *Special Agent in Charge.*

On account of the fact that the varieties of plants and the breeds of animals in Porto Rico were for the most part inferior the station has made it one of its main functions to bring about improvements in the economic plants and animals of the island. A persistent effort has also been put forth to increase the number of crops commercially cultivated and thus to bring about a rational diversification of agriculture. In this work of diversification the station has met with gratifying success, particularly in the large development of the fruit industry.

There were but few changes in the staff of the station during the year. G. L. Fawcett, the plant pathologist, resigned, and J. O. Carrero was appointed assistant chemist.

The station is devoting attention particularly to an investigation of the soils of the island. This work has increased from year to year and has become one of the main lines of experiment. During the year plat work and soil analyses were greatly extended. Experiments with fertilizers for various crops were carried on extensively, particularly with sugar cane, citrus fruits, and coffee.

Experiments in fertilizing citrus trees have been carried on in cooperation with planters in three different districts of the island. These experiments have extended over several years and have shown quite definitely that nitrogen is the limiting factor in producing citrus fruits, while phosphate is second in importance. On the north side of the island complete fertilizers have given best results. Nitrogen was also found to be the limiting factor in the growth of sugar cane. In the fertilizer experiments with citrus fruits it was found that any deficiency in plant food on a given plat could be detected by yellowing or by other change in the leaves of the trees. The weight of the fruit harvested from the unfertilized trees was only 27 per cent of that taken from the fertilized trees. Dried blood appeared to be inferior to ammonium sulphate as a source of nitrogen.

In fertilizer experiments with coffee on red-clay soil nitrogen was again found to be the most important element of plant food. The addition of nitrogen to the soil not only produced a more vigorous growth but gave a darker green foliage and an increase in yield. On account of the expensiveness of commercial nitrogenous fertilizers much attention was given to the growing of legumes. In this work a large number of legumes have been introduced. Cowpeas have given quite satisfactory results, especially a variety obtained from Venezuela. The growth of leguminous cover crops between the rows of cultivated crops has been encouraged among the planters of the island. In citrus groves sword beans and jack beans have given excellent results, and velvet beans and *Centrosema plumeri* have proved extremely valuable as cover crops.

In the study of the effect of strongly calcareous soils on the growth and ash composition of beans, radishes, sunflowers, sugar cane, and other crops it was found that beans and radishes were not affected, even when carbonate of lime constituted 35 per cent of the soil. Sunflowers, soy beans, and sugar cane were somewhat depressed in yield by 18 per cent of lime, while cassava was unfavorably affected even by 5 per cent of lime, and in pineapples a decided chlorosis was brought about by 5 per cent of lime. The addition of carbonate of lime apparently had no effect on the amount of nitrogen, potash, and phosphoric acid contained in the various plants. Some of the

plants which were not affected by carbonate of lime, as, for example, soy beans, bush beans, radishes, and sunflowers, showed a marked diminution in the amount of lime and magnesia in the ash when grown on calcareous soils.

The deposits of bat guano in various caves on the island have been investigated, and from analyses of this material it appears that the phosphoric-acid content of guano ranges from 5 to 30 per cent and the nitrogen content from 0.025 to 8 per cent. Considerable attention was also given to the study of chlorosis with reference to iron nutrition of plants and a selective absorption of mineral nutrients by plants.

A study was made of the possible degeneration in northern vegetable seeds grown for long periods in the island. Work was begun in 1909 with beans, tomatoes, okra, lettuce, and peppers. Seeds of these plants have been grown for a number of generations, but the yields fail to indicate any degeneration due to environment.

It has been found that certain introduced varieties of coffee are better adapted to local conditions than the varieties which were already grown in Porto Rico and that some of these introduced varieties bear at an earlier age and yield larger crops. Vanilla was introduced several years ago by the station and is giving promise of becoming a commercial crop. It is being recommended to coffee growers that they plant vanilla at the base of their coffee trees. When managed in this way little additional labor is required except in fertilization and picking the crop. About 60 varieties of mangoes are under observation, and several thousand inarched trees of superior varieties have been distributed. It is believed that good varieties of mangoes will perhaps find a ready market in the United States.

The station has also devoted much attention to cooperative fertilizer tests and a study of cultural methods and selection of coconuts as well as to variety and cultural tests with root crops and the introduction, testing, and distribution of economic plants.

During the year the entomologist of the station devoted his time principally to the investigation of the insect pests of coffee. The changa also received some attention, particularly with reference to the life history of this pest. Observations were also made on the habits and life history of garden insects, and some work was done in apiculture.

A careful study was made of the fungus diseases of coffee, particularly leaf rot, leaf spot, Cercospora spot of the berries, and root diseases. No satisfactory remedy was found for leaf rot (*Pellicularia koleroga*), but Bordeaux mixture proved to be a satisfactory remedy for leaf spot (*Stilbella flavida*).

The station has gradually built up a good herd of cattle containing dairy animals, chiefly Guernsey, Jersey, and Shorthorns. The bulls

from this herd are sold at moderate prices to planters in order to improve the grade of cattle in the island. Similar efforts are being put forth in improving the horses, swine, and poultry of Porto Rico.

The publications received from this station during the year were as follows: Bulletins 16, The Effect of Strongly Calcareous Soils on the Growth and Ash Composition of Certain Plants; 17, Fungus Diseases of Coffee in Porto Rico, and 18, Citrus Fertilization Experiments in Porto Rico.

The income of the station during the past fiscal year was as follows:

United States appropriation	$30,000.00
Sales, including balance from previous year	3,928.79
Total	33,928.79

The station is taking an active part in the agricultural development of the island. Its work is well received and is directed at the most evident needs. Its greatest need at present is perhaps for additional funds to increase its extension work among the planters of the island.

RHODE ISLAND.

Rhode Island Agricultural Experiment Station, *Kingston.*

B. L. Hartwell, Ph. D., *Director.*

No changes occurred during the year in the members of the staff chiefly responsible in carrying on the different lines of investigation. The research projects were therefore carried forward without interruption. P. H. Wessels, formerly assistant chemist, was made associate chemist, with added responsibility in planning and directing the chemcal work; R. A. Lichtenthaler resigned, and Marguerite W. Elkins was appointed assistant in animal breeding and pathology. A small building was erected containing an office and workroom, and minor modifications were made in the barn near the field experments. These changes added materially to the convenience of operation.

Adams fund projects.—The determinations made in the field of the effect of soil acidity on different kinds of plants were supplemented by further field tests in a study of the influence of plants on the degree of acidity. Some improvement was made in chemical methods which give greater accuracy in the determination of the acidity. The cumulative effect of 22 annual applications of nitrogen in the form of sulphate of ammonia and nitrate of soda was computed during the year. Where no lime had been applied the plat which received sulphate of ammonia showed a lime requirement of 3,500 pounds of calcium oxid more than the plat which received nitrate of soda. Although the lime appeared to have reduced the quantity of organic matter in the soil, there was no evidence that the total nitrogen was thereby diminished.

In the bacteriological work on these plats it was found that in aerobic cultures in acid gelatin there were more types of bacteria from the more acid soil, while in the alkaline gelatin there were more types from the less acid soil. Practically no benefit resulted from the addition of calcium sulphate or of magnesium sulphate. It appeared that the soils merely needed basic material, which was well furnished by calcium carbonate, either alone or in a mixture with magnesium carbonate.

In this long-continued investigation observations have been made on about 280 varieties of plants, including 75 flowers, 25 trees and small fruits, 30 kinds of grasses and clovers, and 150 kinds of miscellaneous crops. In this large list of plants the crops which showed the greatest sensitiveness to soil acidity were asparagus, barley, beets, celery, gumbo, leeks, lettuce, onions, parsnips, peppers, clover, salsify, spinach, and tobacco. It appears to be unsafe to compare ammonium sulphate and nitrate of soda as sources of nitrogen unless in each case the reaction of the soil is made optimum for the growth of the crop. To bring about such a condition a larger amount of lime is commonly required in connection with sulphate of ammonia than with nitrate of soda.

The effect of various crops upon succeeding crops on the same soil was studied by means of pot and field experiments, with special reference to the determination of the cause of the observed effects. It appears that a number of crops are incompatible when grown in succession on the same soil. This fact was most strikingly illustrated when onions followed buckwheat. The use of lime has been found to correct the unfavorable condition in part, but the matter is not yet thoroughly understood.

No definite conclusions have yet been reached in regard to the means of infection of blackhead in turkeys. During the year the experimental methods were somewhat modified, free range with partly controlled feeding being substituted for pen raising. The use of sour-milk rations was continued, but the administration of drugs was abandoned.

The relation of the chemical composition of turnips to the phosphorus deficiencies of the soil as a means of determining the soil requirement for phosphorus was continued as heretofore. A correlation was found to exist between the amount of phosphoric acid applied to the soil and the starch and organic and inorganic phosphorus in the turnips. The investigation of the proximate constituents of plants received considerable attention. This work was confined largely to microscopical observations on the starch in potato vines. Chemical analyses were made in an attempt to learn the chemical differences between tubers of different quality used for seed. This study begins to throw some light on the question of retarded growth due to a lack of different plant-food ingredients.

The study of the influence of physical soil factors and various chemicals upon the growth of plants was confined largely to work with carnations. The data accumulated in this work have not yet been digested. The use of water in pot cultures and the study of the physiological effect of nutrient elements upon plant growth was continued, chiefly in connection with experiments on barley plants at different stages of growth. Similar tests were also made with oats, rye, millet, and buckwheat. This investigation has not yet brought out any final conclusions.

In the study of the lime and magnesia requirements of plants further information was attained by means of pot and field experiments regarding the relation between different calcium and magnesium compounds and the growth and composition of the crop. The results thus far obtained are not considered conclusive, for the reason that difficulties were experienced in maintaining neutral conditions in the soil.

The study of laws governing the breeding of domestic poultry was largely directed during the year to an investigation of the rôle of black and white in the determination of feather pattern and plumage pattern. It appears that the White Leghorn breed has in its inheritance a factor for black pigmentation. It was shown that a mixture of White Leghorn blood in crosses may introduce this factor which will result in the appearance of black pigmentation or a barring of the plumage. This color due to the White Leghorn breed may appear in the form of dark barrings and cuckoo markings. The problem of inheritance of egg weight in fowls also received much attention and positive results were achieved. Families of fowls have been produced which appear to be characterized by laying eggs about one-third smaller than the average size. In the opposite direction, similar success was had and strains of fowls were secured which laid eggs one-fourth larger than the normal size.

In the further study of fowl cholera attention was directed largely to an attempt to distinguish between cholera and typhoid-like infections by means of agglutination tests. This method appears to distinguish readily the cholera types from noncholera types which are culturally similar. Among 17 strains of fowl-cholera organisms tested with reference to their resistance-producing power toward a highly virulent culture, only one was found which produced any resistance. This immunizing culture was tested against five other virulent strains and proved to be protective against three of them. The experimental animals used in this investigation were poultry and rabbits.

In the project on bacterial infection of eggs attention was given largely to experiments with the agglutination test applied in a study of fowl cholera.

Work with Hatch and other funds.—A large amount of breeding work was done in close connection with the Adams fund projects. In a study of the sex ratios in pigeons and of problems connected with heredity in these birds it was found that the normal ratio of the sexes of pigeons is 105 males to 100 females. The death rate in the two sexes appears to be about equal, and no marked tendency was noted for one sex to be weaker than the other. A comparison of the numbers of each sex hatched from first eggs and from second eggs showed no differences in the sex ratio. The mean time of the hatching of the first egg was found to be 16½ days after the laying of the second egg, and the mean incubation period for the second egg proved to be 17 days. The data thus far obtained indicate no means of determining the sex of pigeons, which seems to follow the law of chance.

A wide range of field experiments, largely of an agronomic nature, were carried on during the year. Some of the results of the 20-year experiment on the comparative value of different sources of phosphorus were summarized. In the course of this work a comparison of guano, ground bone, and dissolved phosphate rock was continued for six years. The ground bone proved to be most effective and dissolved phosphate rock least effective. A summary of the results obtained during the whole 20-year period indicates that dissolved bone black must be placed among phosphates of the first rank, while dissolved phosphate rock holds an intermediate place, being decidedly superior on both the limed and unlimed soils to double superphosphate and certain other sources of phosphate. On account of the fact that phosphorus in raw phosphate rock costs only about one-half as much as in the other sources of phosphorus it ranks first from the standpoint of economy.

Other field experiments included rotations with chemical fertilizers and manure with and without legumes, a test of spring versus fall plowing, fertilizer experiments to determine the plant-food requirement of different soils and crops, experiments with lime in different forms and degrees of fineness, and in the use of sodium as a substitute for potash. Considerable work was also done in studying the after effects of fertilizers on lawn grasses, methods of producing and handling seed potatoes, methods of improving corn by selection, and a study of the effect of detasseling corn. It was found that leguminous cover crops give much better results than rye in the continuous culture of corn, and that little difference results from the use of different forms of lime of an approximately equal degree of fineness. Some evidence was also obtained that soda may to some extent serve as a substitute for potash in soils.

The following publications were received from this station during the year: Bulletins 157, Studies on Fowl Cholera—III, The Inheritance in Rabbits of Immunity to Infection with the Bacterium of Fowl

Cholera; 158, Studies on Inheritance in Pigeons—I, Hereditary Relations of the Principal Colors; 159, Studies on Fowl Cholera—IV, The Reciprocal Relations of Virulent and Avirulent Cultures in Active Immunization; 160, The Comparative Effect on Different Kinds of Plants of Liming an Acid Soil; 161, Studies on Inheritance in Poultry—II, The Factor for Black Pigmentation in the White Leghorn Breed; 162, Sex Ratios in Pigeons, Together with Observations on the Laying, Incubation, and Hatching of the Eggs; Inspection Bulletins, May, 1914, Analyses of Feeding Stuffs; June, 1914, Analyses of Commercial Fertilizers; May, 1915, Analyses of Feeding Stuffs; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
Miscellaneous, including balance from previous year	6,784.57
Total	36,784.57

The Rhode Island station continues to make contributions of a fundamental nature to our knowledge of poultry diseases, poultry breeding, and in the field of soil and fertilizer investigation. The problems to which the station is giving its best energies are not only interesting from a scientific standpoint, but are of prime importance to practical agriculture in the State.

SOUTH CAROLINA.

South Carolina Agricultural Experiment Station, *Clemson College.*

J. N. Harper, M. Agr., *Director.*

The work of the South Carolina station proceeded without essential change of policy during the year. Serious difficulties were met in the conduct of some of the Adams fund projects, and a few of these projects were abandoned, while most of the others were reorganized and strengthened on the basis of somewhat modified plans. C. A. McLendon was appointed field pathologist to succeed L. O. Watson and given charge of the work in cotton resistance to anthracnose and in devising methods for controlling this disease.

Adams fund projects.—The study of the relation of temperature to insect activity progressed satisfactorily. Particular attention was given to the correlation of weather conditions and insect outbreaks. Rather complete records have been kept since 1907, and studies are being continued on the hibernation of a number of species of insects. A new apparatus for the control of temperature and moisture conditions was devised and was used in studying the squash bug and potato bug. It is hoped that the results obtained in this work will furnish a basis for the prediction of outbreaks of the insects in question.

Apparently the determining factors in the hibernation of insects are evaporation and body temperature.

Decided progress was made in the study of wireworms, particularly *Monocrepidius vespertinus* and *Horistonotus uhlerii*. In this work attention was given chiefly to the relation of temperature and soil moisture to the activities of the insects. It was found that these wireworms would not lay eggs in a compact soil or in a soil containing 12 per cent or more of moisture. A number of natural enemies of *M. vespertinus* were noted, particularly the nighthawk and species of robber flies and field spiders. In the control of these pests a well-planned system of rotation has been found to be the most effective treatment.

The study of the effects of pollen from barren stalks of corn on the amount of barrenness in progeny made considerable progress. The results obtained during the year were apparently quite positive, but final judgment is reserved on account of the difficulty of excluding the influence of environment in causing the temporary barrenness. It appears that barrenness may be to some extent hereditary.

Encouraging progress was also made in the project on the fecundation of the Rotundifolia grape. It was found possible in the greenhouse to force the Scuppernong and James varieties of grape to bloom and set fruit during the month of April. As soon as the fruit had set on the vines in the vineyard it was removed, and the young canes were pruned back, forcing them to produce young shoots from the season's growth. Close observations were made during the whole blooming period of the Rotundifolia grapes without discovering bees on the flowers at any time. It was noted that while bees visited clover and other flowers in the vicinity of grapevines, they totally ignored the grape blossoms.

Work was continued on the study of cotton anthracnose, which was more generally destructive than usual during the year. The hot-water treatment for seed received further attention. Cotton seed was soaked for 15 minutes in water at a temperature of 75° C. At the end of the season a comparative examination indicated that the disease prevailed to the extent of only 1 per cent in plants from treated seed, while it affected 15 per cent of the bolls on plants from untreated seed. Incidentally it was learned that different varieties of cotton seed are quite differently affected by the hot-water treatment, some being killed at 72° C., while others withstand a temperature of 76° C.

A beginning was made in the work connected with the new project on bacterial diseases of cotton, particularly the angular leaf-spot caused by *Bacterium malvacearum*. A large number of seeds were inoculated in the laboratory and planted in the field, where the disease was carefully studied throughout the season. In connection

with this work cotton seed was subjected to several treatments, and spraying experiments were carried on.

The study of the cause of the shedding of squares and young bolls in cotton received much attention. Data had been accumulated at the Pee Dee substation on the shedding of bolls and on the soil moisture during two seasons, and these findings will be compared with the results obtained at the main station. It appears that the lack of sufficient soil moisture is the chief factor in causing a shedding of the bolls. It was found that in large containers 300 to 417 pounds of water were required to produce a pound of dry matter in cotton. Incidentally it was learned that cotton requires more water in August than during any other month.

In studying the cause of the partial insolubility in water of potash salts when mixed with basic slag it was found that there is a rather large source of error in the ordinary official method for determining potash in soils and fertilizers, due to the occlusion of potash by the heavy precipitates of iron and aluminum. Other bases appear to be affected in a similar manner. An effort is being made to devise an electrical method for the determination of potash, soda, and lime. The results thus far obtained indicate that there is more lime and potash in the solution than is indicated by the determination made by the ordinary method.

Work with Hatch and other funds.—Various fertilizer experiments were conducted at the main station and at the substations, particular attention being given to the potash requirements of soils and crops. Analyses were made of a large number of materials which are considered possible sources of potash. Some attention was also given to the limiting factors of fertility, especially for corn and cotton. It appears that nitrogen and phosphorus are the chief limiting factors.

The agronomic work included variety tests with cotton, corn, oats, cowpeas, and grasses, breeding experiments with corn, cotton, and barley, and various rotation experiments involving alfalfa, hairy vetch, and other legumes. With both corn and cotton it was found that rock phosphate may be most profitably applied in small applications. Stable manure proved to be more efficient as a fertilizer for cotton than for corn. Of the various winter cover crops thus far tested, oats appears to be the best. Numerous soil analyses were made in connection with plat and rotation experiments.

The horticultural work of the station, in addition to the Adams fund project, included a study of the variation of individual trees of standard varieties of apples, variety tests with peaches, plums, Japanese persimmons, grapes, and other small fruits, selection and breeding experiments with Irish potatoes, and tests of cultural methods suitable to asparagus, grapes, peaches, and strawberries. It was found that apples from certain trees keep better and remain firm longer

than apples from other trees of the same variety. These observations were repeated for verification, but the cause of this difference is not yet apparent.

The general entomological work of the station included the study of scale insects, cotton root-louse, and other insect pests. Satisfactory methods of control were worked out for citrus purple scale, oyster-shell scale, and other scale insects. Some attention was also given to methods for controlling the bollworm, the cotton billbug, cornstalk borer, and flies.

Work on the plant-disease survey of the State was continued, particular attention being given to the diseases of corn, alfalfa, and cotton. A species of Sclerotinia caused serious trouble on alfalfa in Greenville County. The study of the wilt of cowpeas and cotton was carried on in cooperation with the Department of Agriculture. A certain degree of resistance to root knot was noted in several varieties of cowpeas.

Experiments in animal husbandry were confined largely to a comparison of the feeding value of various forage crops for pork production, the study of rations for dairy cows and work horses, and simple breeding experiments in which pure-bred sires are used.

The publications received from this station during the year were as follows: Bulletins 176, Practical Orchard Pruning; 177, Analyses of Commercial Fertilizers; 178, Results of Fertilizer Experiments Conducted at Summerville, S. C.; 179, The Spotted Click Beetle (*Monocrepidius vespertinus*); Corn and Cotton Wireworm (*Horistonotus uhlerii*); Circular 26, Cooperative Experimental Work with Winter Cover Crops; and the Annual Report, 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	14,922.88
Farm products, including balance from previous year	2,402.66
Total	47,325.54

The entire Adams fund program of the South Carolina station was reorganized on a better basis and given a new life. The research work of the station is now going forward with renewed energy. The more immediately practical work of the station, with the aid of its substations, covers the principal lines of agricultural interest.

SOUTH DAKOTA.

South Dakota Agricultural Experiment Station, *Brookings.*

J. W. Wilson, M. S. A., *Director.*

The work of the South Dakota station during the year proceeded without interruption or serious change of policy. Dr. E. C. Perisho was appointed president of the college and has manifested much

interest in the welfare of the station. W. Cramer, jr., was appointed assistant in animal husbandry. Otherwise no change in the staff occurred during the year. The persistent call for speakers in connection with extension work made it necessary to define rather sharply the limitations of the station activities in order to prevent the demands upon the station men from becoming excessive. The plant for the manufacture of hog-cholera serum is maintained as a college enterprise, in which the station has no responsibilities.

Adams fund project.—The long-standing project on the improvement of hardy wild fruits of the Northwest by breeding and crossing was continued along the same lines as heretofore. During the year a plum was originated at the station which seems to be the best of those thus far produced, and it is being widely introduced throughout the State. The cross between the sand cherry and the Japan plum has proved to be a success. In breeding pears for immunity to blight 35 hybrid varieties were used, and it appeared that some of these have a certain amount of immunity to this disease. These varieties will be tested more widely by cooperative arrangements with farmers. This project also involved considerable work on the technique of breeding and on the various forms of hybrids. In general, multiple hybrids have been found to be best.

The study of the influence of rotation upon the maintenance of soil fertility was continued on the original 112 plats on the west farm of the station and on a large number of plats on the east farm. On all plats nitrogen, potash, and phosphoric acid are determined, and in one series of plats the lime and magnesia are also determined. Some of the plats are maintained continuously in legumes. The aim of this investigation is to learn the soil changes which result from different treatments. The first set of samples was taken in 1908 and the second in 1915. During the coming year humus determinations will be made, and bacteriological studies will be begun on the plats.

In a study of plant correlations as connected with yielding capacity the work was confined to pedigreed wheat. A table of correlations was worked out as to the length of head for the crop of the previous year. Comparisons were impossible on the crop of the year on account of the prevalence of rust. Only a single factor can be taken at a time. It is proposed to extend the work to the correlation of the protein content of corn and yield of this crop.

The study of water as a limiting factor in the growth of sweet clover was conducted in the greenhouse and in a screened cage. In this work three types of soil were used, and determinations were made of the hygroscopic moisture content of each soil at three different depths. The moisture content was maintained in the different containers at different percentages of the water capacity of the soil.

The project on digestibility of grains and fodders for horses was continued during the year by feeding an unbalanced wide ration and studying the effect on digestibility. Two horses were used in this experiment from January to June. Samples of feces were frequently taken for analysis, and blood samples were examined to determine the blood count every 10 days. Careful physical examination of the animals was frequently made by the veterinarian. The evidence thus far obtained indicates that horses do not digest the protein more completely in a ration deficient in protein and that the periosteum is to some extent absorbed under a ration deficient in protein, thus rendering the animals subject to joint troubles.

The rôle of water in rations for dairy cows was studied in two trials of 30-day periods. The cows were watered once a day at first in order to determine the effect of the reduced amount of water, but the deficiency of water seemed to be made up from the body tissues, and for this reason in the second test the cows were watered only once in 60 hours. In some cases fever was apparently produced by this treatment. A correlation was found between the temperature of the body and the melting point of butter fat. It is proposed to carry on another test in which the cows will be maintained on a half ration of water as determined by previous experiments.

Work with Hatch and other funds.—In the horticultural department, in addition to its main line of investigation under the Adams fund, a great quantity of work was done on breeding roses. Several strains produced at the station were distributed for testing. Certain complex hybrids have been produced which give a greater amount of variation. The horticulturist also did much work with alfalfa, both in breeding and methods of culture. It was found possible to obtain a better stand in the case of a hardy Cossack variety of alfalfa by growing seedlings in a nursery and transplanting them by means of a tobacco transplanter. When seedlings a year old were transplanted at distances of 3 feet apart both ways it was found that they spread so as to cover the ground during the first season of growth.

A study was also made of the milling and culinary properties of proso and kaoliang. In cooperation with the department of home economics of the college this study resulted in the development of a number of recipes for cooking preparations made of proso and kaoliang.

Aside from cooperative work with other departments of the station the chemical department was largely occupied in the study of sugar beets with especial reference to the production of a superior quality of beet seed and the breeding of strains containing a higher percentage of sugar.

The dairy department carried on a number of experiments with the pit silo, with methods of handling dairy products, milking

machines, and the development of a supply of ice on the farm. Bulletins were issued on the pit silo and on the methods of testing and handling dairy products. Through cooperation with farmers 48 silos were built in the western part of the State, using different methods of construction. The pit silo was found to be quite satisfactory and also cheap. In connection with a study of milking machines all of the leading types of milking machines were installed, and a comparative test made on the effect on cows, ease of cleaning, and methods of handling the machines. As a means of producing a supply of ice on the farm it was found convenient to freeze water in rectangular boxes made of galvanized iron with dimensions 10 by 12 inches by 2 feet. In cold weather the water freezes during the night, and the ice cakes may be removed and placed in the ice house the next morning.

The agronomy department carried on a large variety of field experiments, including a study of the effects of different depths of plowing from 4 to 16 inches, a comparison of varieties and strains of alfalfa, numerous rotation experiments, a study of the effect of the size of seed pieces in potato production, variety tests with cereals, and selection of corn for protein and height of ear. Considerable attention was given to the study of sweet clover as a field crop. In this work data were collected as to its habits of growth, moisture requirements, and as to the yield of hay and seed.

In selecting and breeding corn for protein and oil content it was found that the highest yields of protein per acre were secured from strains of corn high in protein, and the same statement may be made for oil content. It was also shown that with increasing maturity the percentage of oil in the dry matter of corn increased. From a study of the relation of the size of the seed piece of potators to production it appeared that the use of a medium or fairly large seed piece produced a greater proportion of marketable potatoes than was obtained from the use of culls as seed. Both the shape of the tubers and the average weight of the tubers were improved by the use of reasonably large seed pieces.

The animal-husbandry department conducted feeding experiments with carload lots of steers, using rations of silage and hay made from clover, sweet clover, alfalfa, or prairie grass. This preliminary feeding period extended over 90 days. During the subsequent feeding period grains were added to the silage and hay ration. Silage and linseed meal appeared to give the most economic gains. Experiments have also been begun in crossing fat-rumped sheep with the common breeds of sheep in the State. An experiment was carried on to determine the value of rape pasture for pigs allowed the range of cornfields. The results indicated that flint corn was about equal to dent for pigs, and that in all cases pigs on rape pasture made

better gains than those which received corn alone. Kaoliang proved inferior to corn as a fattening ration for pigs.

In steer-feeding experiments corn silage produced more than twice as much increase in weight as sorghum silage, when fed as the sole ration. It was concluded, therefore, that where the corn plant will mature satisfactorily there is no benefit to be derived from the use of sorghum in silage. The addition of leguminous hays, particularly alfalfa hay, to a silage ration produced more rapid gains, but the gains were not always economic.

The following publications were received from this station during the year: Bulletins 151, Trials with Sweet Clover as a Field Crop in South Dakota; 152, Testing and Handling Dairy Products; 153, Selecting and Breeding Corn for Protein and Oil in South Dakota; 154, Brief Instructions for Building a Pit Silo; 155, Selection and Preparation of Seed Potatoes—Size of Seed Piece and Bud Variation; 156, Kaoliang, a New Dry Land Crop; 157, Rape Pasture for Pigs in Corn Field—Kaoliang for Pigs; 158, Proso and Kaoliang as Table Foods; 159, Progress in Plant Breeding; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	12,000.00
Farm products, including balance from previous year	17,936.52
Miscellaneous, including balance from previous year	6,938.43
Total	66,874.95

The South Dakota station is making a very creditable showing along the lines of investigation which it maintains, and is exerting a widespread influence. The work of the station appears to be closely followed by the farming population of the State, and abundant opportunity is therefore had for cooperation with the farmers, particularly in testing varieties of fruits and forage crops originated or studied at the station.

TENNESSEE.

Tennessee Agricultural Experiment Station, *Knoxville.*

H. A. Morgan, B. S. A., *Director.*

During the year investigations in horse and mule breeding were inaugurated on an extensive scale. About $10,000 was received from private sources for the purchase of Percheron stock for use in this work. A live-stock pavilion was also erected at a cost of $8,000, and two concrete silos (Pl. IX, fig. 1) were built at the station farm. A notable addition to the equipment of the station was made by the acquisition of the "Cherokee tract," comprising about 569 acres, lying in a bend of the Tennessee River and opposite the present farm.

This new tract of land was purchased at a cost of about $140,000. Of this sum about $25,000 was given by the city and individuals, and the remainder was provided by the county through the issuance of bonds. The purchase of this tract is a high testimonial to the esteem in which the agricultural college and experiment station are held locally.

Adams fund projects.—Work on the project on humus formation included numerous experiments in cylinders with soils from four different localities. The work is not confined to the study of humus formation, but includes an investigation of the fate of nitrogen whether applied to the soil as nitrate of soda or manure, and statistics of nitrogen as to the amount applied and removed in a series of years. The loss of nitrogen through drainage is being studied in a series of drainage cylinders 1, 2, 4, and 6 feet deep. A large amount of information has been acquired in the course of this project, but some of the results are rather difficult to interpret. It is expected that the cooperation of the bacteriological department will be secured on this project.

In connection with the soil work of the station an unusually complete equipment for the investigation of soil leachings was devised and constructed. This is located on a hillside and is protected from inclement weather. The soil tanks in the equipment are exposed to natural weather conditions, and the whole device is excellently well arranged for both scientific and educational use.

The investigation of factors influencing the lime requirement of soils made satisfactory progress. Thus far the investigation has included a comparison of silicates and carbonates as sources of lime and magnesia in plants and the determination of soil carbonates. The work is conducted both in the laboratory and in outside cylinders. In searching for a reason for the rapid decomposition of both magnesium and calcium carbonates a possible bacterial activity was eliminated by placing fine silt in contact with the carbonates. It was soon found that carbonic acid was evolved as a result of the lime and magnesia uniting with silicic acid. A convenient method has been developed for determining the immediate and continuous lime requirement of soils. Considerable work was done to determine the rate at which burnt lime becomes transformed into carbonate.

An unforeseen difficulty was met in the further study of the resistance of clover to Colletotrichum disease. The disease apparently became nonvirulent throughout the State. It was therefore impossible during the season to test the resistance of immune clover to the fungus. A study was made of the behavior of supposedly resistant and nonresistant seed toward temperature and various other external factors. Attention was also given to a study of the effect of the juices of resistant and nonresistant clovers on the germination

of Colletotrichum spores. In order to simplify the approach to the general problem of physiological resistance, a beginning was made in the study of simple reactions which occur in the infection of Spirogyra by fungus parasites.

In the study of pear blight progress was less satisfactory. Some observations were made on the relative resistance of the seedlings under field conditions. A large number of apple and pear seedlings are being grown for use in this work. In continuing the project on the wilt disease of the tomato some quite highly resistant strains of tomato were obtained and are being improved by selection.

During the year attention was given particularly to a study of the effect of different conditions on bacterial activity in the decomposition of organic matter. The amount of carbon dioxid and ammonia given off are taken as a measure of bacterial activity. This work is carried on in the laboratory with the use of cottonseed meal and straw. Some results are also becoming evident from the study of the effect of organic acids on decomposition.

In studying the carbon requirements of Azotobacter attention was given chiefly to *A. finlander*, especially to its physiology and the production of spores. Spore formation had not been previously observed in this species. Some work was also done in devising a method for growing plants under exclusion of bacteria by using ultra-violet rays for freeing the seed from bacterial contamination.

The life history of the peach borer was studied under field conditions in a block of about 400 peach trees. Observations were made on the date of egg laying and hatching. A large mass of data was accumulated on the number of broods and on various points in the life history of this pest. When the borer was prevented by various devices from laying its eggs about the crown of the tree, it was observed laying its eggs upon the leaves.

The study of the hog louse was resumed with special reference to its life history and habits. It was found that this insect does not live long when separated from the host and shows an abnormal development under such conditions. It became necessary, therefore, to confine the study to lice actually on the living pig. It has been shown that the pest can readily be destroyed by dipping, but reinfection takes place promptly, and further information is needed on the life history of the insect in order that a more effective means of control may be devised.

The investigation of the life history of the cattle tick was completed, and a bulletin on this subject was issued by the station. It is found that the parasitic stages of ticks are little affected by changes in temperature, but that the nonparasitic stages vary greatly with the season and temperature. Thus the period before egg laying may vary from 2 to 56 days, and the oviposition period from 9 to 122

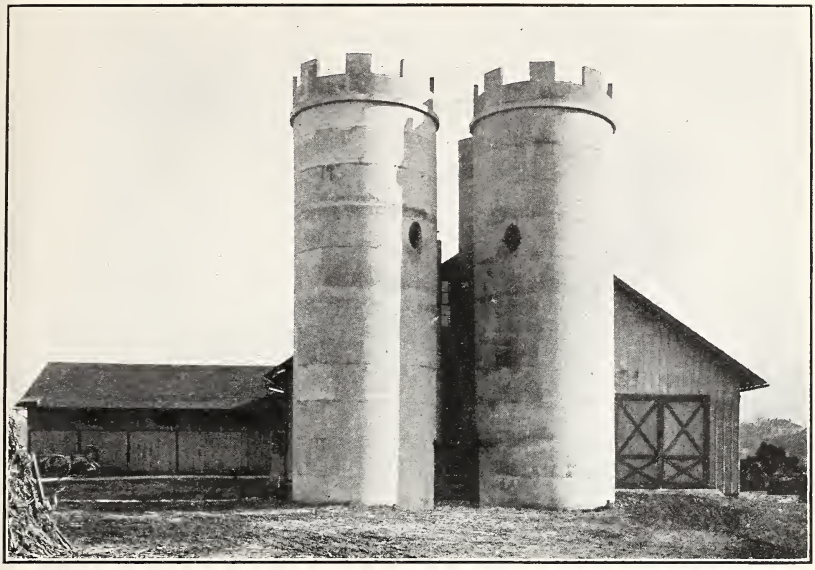


FIG. 1.—CONCRETE SILOS, DIMENSIONS 14 BY 49 FEET, TENNESSEE STATION.

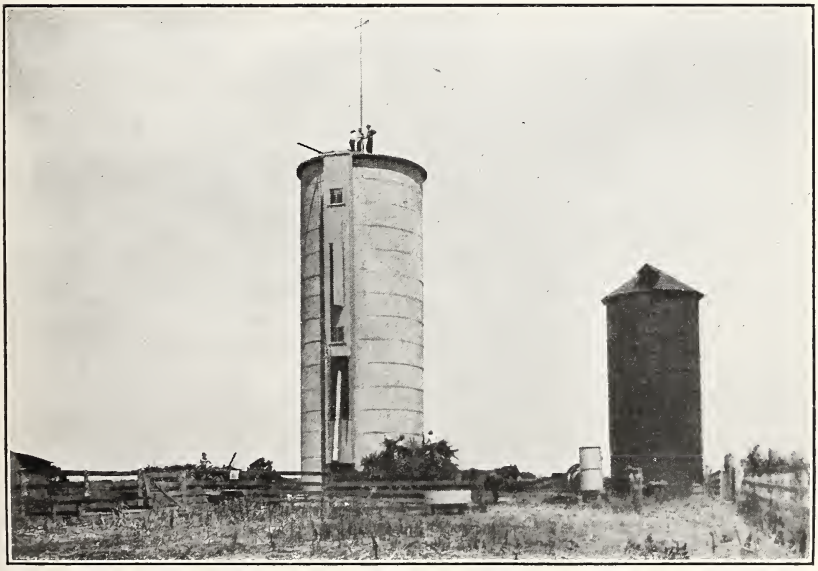


FIG. 2.—FILLING SILOS AT FEEDING AND BREEDING SUBSTATION, TEXAS STATION.



FIG. 1.—PLOWING WITH TRACTOR AT FEEDING AND BREEDING SUBSTATION, TEXAS STATION.

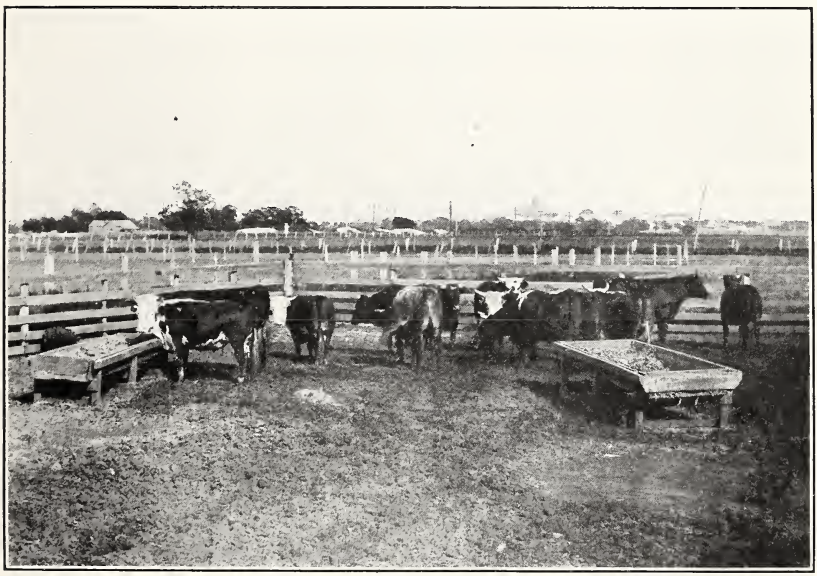


FIG. 2.—STEERS ON FEED AT FEEDING AND BREEDING SUBSTATION, TEXAS STATION.

days. It was found that each tick engorges itself with blood three times in the course of its development. The rate of egg laying varies greatly with the temperature. It appeared that seed ticks are destroyed by a temperature of 4° F.

The project on the improvement of Japanese clover was continued. Of 258 selections which were under observation during the previous season 75 were considered of sufficient promise to be retained in the experiment. Repeated tests were carried out to determine the effect of lime and fertilizers and the rate and time of seeding upon the growth of Japanese clover. It was found that ground limestone used at the rate of 2 tons to the acre greatly increased the hay yield.

The project on the influence of temperature on the growth of plants was continued in cooperation with 15 Weather Bureau stations. At these stations three varieties of soy beans and an early and late variety of corn were grown for observation. One half of each plat was watered and the other unirrigated. Attention is given chiefly to the possibility of determining the relation between temperature and rainfall and the length of time required by a crop to reach a given stage.

Work with Hatch and other funds.—A wide range of experiments was carried on under Hatch and other funds. At the station farm and also at Jackson a steer-feeding experiment was conducted for the purpose of determining the beef yield per acre from various rotations. There are 7 acres devoted to this work, and the investigation has been going on for about nine years. The acre devoted to soy beans and barley appeared to be the most effective, but was nearly equaled by the alfalfa acre. Comparative tests were also made of rations for dairy cows, including cottonseed meal and gluten meal. Cottonseed meal, silage, and hulls in various proportions were used in some feeding experiments with steers.

A comparison was also begun between hand milking and machine milking. Some work was done in selection of fowls for high egg yield in cooperation with the farmers. A set of experiments was begun for gaining reliable data on the feeding value of corn, alfalfa, cottonseed meal, and buttermilk for hogs. A preliminary survey was made of the extent and distribution of the sheep industry in the State.

A large amount of experimental work with field crops was carried on. These experiments included methods for the control of chickweed in alfalfa, dynamiting land, fertilizer experiments with wheat, cultural experiments with tobacco, and cooperative experiments with cattle in methods of producing various field crops. It was found that apparent antagonism exists between orchard grass and chickweed which has been one of the worst troubles met with in securing a good

stand of alfalfa. In some liming experiments with cowpeas it appeared that 1,800 pounds of lime per acre applied 10 years ago is still effective. In a comparison of cultivation versus noncultivation for corn the best results were obtained from the uncultivated plats. At the west Tennessee substation further progress was made in working out practical systems of rotation for that part of the State. Variety and cultural experiments were also carried on with wheat, barley, and rye.

The horticultural work of the station during the year included a study of the effect of using immature vegetable seeds, practical methods for controlling the peach borer, the treatment of seed potatoes for second crop, the effect on the quality and color of the grape of inclosing grape clusters in bags of various colors, methods of summer-pruning the peach, rotation systems to be used in strawberry beds, fertilizers for orchards, sweet potatoes, home gardens, and practical methods of spraying for insect pests and fungus diseases.

The following publications were received from this station during the year: Bulletins 106, Suggestions for the Control of Injurious Insects and Plant Diseases; 107, The Nonexistence of Magnesium Carbonate in Humid Soils; 108, Summer Pruning the Peach; the 109, Fertility and Crop Experiments at the West Tennessee Station; 110, A Survey of Sheep and Lamb Production in 1914; 111, Two Equipments for Investigation of Soil Leachings—A Pit Equipment—A Hillside Equipment; and 112, The Small Grains in Tennessee.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation, including balance from previous year	22,731.70
Farm products, including balance from previous year	7,739.27
Total	60,470.97

The Tennessee station is steadily growing in strength and in influence. The acquisition of the Cherokee tract not only increased the facilities of the station for scientific work, but brought out the more active interest and sympathy of the citizens of the State. The station has recently done much to arouse interest in its work in the three main geographical sections of the State and has been fortunate in securing substantial aid and active interest.

TEXAS.

Texas Agricultural Experiment Station, *College Station.*

B. Youngblood, M. S., *Director.*

The station underwent a satisfactory growth and development during the year in various phases of its activity. Several buildings were erected, including a new dairy barn with separate milk room, a

greenhouse and insectary building, and a building for the storage of soil samples and other material in connection with the chemical work. Additional room is needed for the necessary expansion of the station, and plans have been drawn for a large building to accommodate the station work. The State appropriation received by the station was $87,500, and for the coming year the appropriation will be $135,000. This will be used as heretofore in the maintenance of the branch stations and in supplementing the Hatch and Adams funds at the main station.

Adams fund projects.—The study of inheritance in the honeybee was carried on actively. The mating work was done at Waller, where there are supposed to be no wild or other bees. The first cross was made between the Carniolan drone and Italian queen. The reciprocal crosses between these two kinds of bees was also made. It was soon found that the blood of the queens is often much mixed, and the project has proved much more difficult than was anticipated. The attention of the entomologist was so completely occupied with the work in hybridizing bees that little time was left for the project relating to the effect of powdered lead arsenate upon the boll weevil.

Some progress was made in studying soil types in relation to tubercle production on leguminous plants, especially alfalfa. Some difficulty was experienced in preparing a suitable culture medium.

The investigation of the blossom-end rot of the watermelon showed it to be due to a species of Colletotrichum, but the manner of infection has not yet been determined. The infection appears to take place through injuries caused by the spotted cucumber beetle. Spraying work for the control of this disease did not yield satisfactory results. Much microscopical work remains to be done on this project, particularly with reference to the possible association of Colletotrichum and Fusarium in causing the disease.

The investigation of the nutritive value of feeds progressed actively. Sheep are used in the digestion work, and a respiration chamber has been built for this phase of the investigation. The carbon and nitrogen balance will be determined. Possibly swine and poultry will later be used in the place of sheep. In preliminary work on this project numerous determinations were made of the chemical composition and the digestibility of the common feeds which are to be used in the experiment. Incidentally in connection with the investigation some improvement was made in a method for the determination of the total fatty acids and other constituents of ether extracts.

Considerable progress was made in the project on soil studies. In this work soils have been divided into groups according to their nitrogen content, and the quantity of nitrate produced after inoculation with nitrifying organisms is determined. It has been found

that soils of the same nitrogen content differ greatly in nitrate formation. The cause of this difference has not yet been determined. Some of the soils which show slow nitrification produce fine crops with a high nitrogen content, at least in pot experiments. In addition to pot experiments the project included cooperative field tests in several localities.

Considerable difficulty was experienced in the project on swamp fever or infectious anæmia. It appears to be difficult to maintain the virulence of the virus. Soon after an apparently standard quality of virus is obtained it begins to show attenuation and will not produce the disease by inoculation. The disease was apparently transmitted to the dog in one case, and from this animal to a mule with the development of typical symptoms.

In the project on breeding blackberries and raspberries progress was made along the same lines as heretofore. Attention has been given chiefly to hybrids between blackberries and raspberries. Some of the hybrids have borne fruit, and from this fruit several hundred seedlings have been obtained. It is hoped that a hybrid may be secured which will be better adapted to the climate than is the raspberry. This work is carried on partly in the greenhouse and partly on a plat of about 1½ acres planted to raspberries and blackberries.

In the project on cotton breeding attention was given chiefly to purifying the strains used in the experiment, including Egyptian, Sea Island, and Short Staple. Hybrids have been produced both within and without the species, and with some of these hybrids the third generation has been reached. A great mass of data has been accumulated regarding the inheritance of height of stalk, length of branches, length of internodes, and leaf characters.

Work with Hatch and other funds.—The agronomic field work of the station is carried on to a considerable extent at the 11 branch stations, which are under the direct control of the main station. The work is so organized that the experiments at the branch stations are largely in the nature of a repetition and verification of experimental work carried on at the main station. This work appears to be carefully supervised. It includes general cultural experiments with rice and work in soil and crop improvement, especially with corn, oats, cowpeas, and cotton. Sudan grass has been grown at the station since 1911, and by means of cooperative experiments the interest in this crop throughout the State has been greatly stimulated. In this work nearly 5,000,000 pounds of Sudan grass seed was produced and distributed.

The chemistry department conducted soil work particularly on the relation of chemical composition to fertility. Some work was also done on cottonseed meal as a human food and on the nutritive value of honey and pecans. In connection with the work of feed

control a study of rice and its by-products is under way, and in connection with the fertilizer work determinations are being made of the variability of the phosphoric acid in cottonseed meal and Thomas slag. During the year a large number of routine analyses were made of commercial fertilizers and feeding stuffs.

The entomological department continued its work on the turnip louse which was formerly supposed to be identical with the cabbage louse. This species is being carefully studied for the purpose of determining the length of the different generations at various seasons of the year. Soap preparations gave good results in controlling the pest. The turnip louse feeds on radish and mustard as well as on turnip and appears to migrate from the turnip to grass in the spring. Considerable attention was required in carrying out the inspection for foul brood of bees.

The department of plant pathology studied the black mold of corn with reference to its cause and the conditions under which it occurs most seriously. Moist weather appears to be favorable to infection. The fungus cause of the trouble has not been isolated.

The veterinary department continued the study of Texas fever and carried on some experiments with bacterins in the treatment of garget. The horticultural department continued its study of crown gall. Various treatments have been tested for the control of this disease. None of these treatments has proved so satisfactory as copper sulphate. During the year a beginning was made in forestry work, and a planting was made of evergreens adapted to southern climate.

The animal-husbandry work of the station included breeding experiments with sheep with reference to meat and wool production, feeding experiments with cattle in which cottonseed meal, corn, feterita meal, and other feeds were compared as supplements to silage, and experiments on a large scale in the use of silage for steers. The poultry work of the station included feeding experiments in which beef scrap and cottonseed meal were compared with regard to their efficiency in egg production.

The following publications were received from this station during the year: Bulletin 164, Commercial Feeding Stuffs, 1913—Feed Law; 165, Ammonia-soluble Inorganic Soil Colloids; 166, Digestion Experiments with Texas Feeding Stuffs; 167, Commercial Fertilizers and Their Use; 168, Commercial Fertilizers in 1913–14; 169, The Total Fatty Acids and Other Ether-soluble Constituents of Feedstuffs; 170, The Composition of Texas Feeding Stuffs and Their Utilization; 172, Sudan Grass; Circulars 5, Appropriations Asked for the Main Station and Substations, Biennium 1915–16 and 1916–17—Information Concerning Experiment Stations in General and the Texas Station in Particular; 6, How to Comply with the Law Regulating the

Sale of Concentrated Feed Stuffs in Texas; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	89,763.78
Individuals, including balance from previous year	1,601.63
Farm products, including balance from previous year	9,232.61
Total	130,598.02

The Texas station is efficiently administered, and the funds economically employed. An aggressive, constructive attitude characterizes its management. The station is addressing itself to many of the more important immediate problems of agricultural development in the State, and the effects of its work are greatly extended and furthered by the system of branch stations representing different climatic and soil conditions.

UTAH.

Utah Agricultural Experiment Station, *Logan.*

E. D. Ball, Ph. D., *Director.*

Satisfactory conditions prevailed during the year at the Utah station. A State appropriation was received for a new building to cost $55,000, to be used jointly by the college and station for physical, chemical, and bacteriological work. The State appropriated for the use of the station during the ensuing biennial period the sum of $15,000 per year. Dr. L. D. Batchelor, horticulturist, took leave of absence, and W. H. Homer was assigned temporarily in charge of his work. W. E. Goodspeed, assistant in the department of horticulture, was transferred to the station roll, to devote all his time to research work.

Adams fund projects.—The study of the solubility of lead arsenate in different salt solutions and of the effect of soluble arsenic absorbed by plants was practically completed during the year. In the course of this work a new method for the determination of arsenic was devised and gave very satisfactory results. A description of the method has been prepared for publication. The results of both experiments in which lead arsenate and alkalis were added to the soil are also being prepared for publication.

The investigation of the origin of nitrate accumulations in arid soils was continued, and large areas were studied and mapped during the course of this work. It has been found that the quantity of alkali, especially nitrates, varies decidedly in the different geological horizons. It is possible, therefore, to map soils derived from different

rocks with reference to their value for agricultural purposes and also with reference to the danger of excessive nitrate deposits. A study of more than 400 samples of original rock showed the presence of sodium nitrate, and was thought to indicate that the so-called niter spots are produced by leachings from those rocks. The soils which contain a high nitrate content have been found to contain also large percentages of other alkali salts, such as chlorids and sulphates of sodium, calcium, and magnesium.

The project on the formation and movement of nitrates in irrigated and arid soils was continued actively in cooperation with the bacteriological department. The data obtained during the year show a definite correlation between the quantity of water applied to the soil and the bacterial activity in the soil as well as the growth of the crop.

Satisfactory progress was made in the study of factors influencing the bacterial activities of soils. The work thus far done shows that there is a wide difference in the influence exerted by various soluble salts upon the ammonifying powers of the soil. Some compounds are toxic in fairly dilute solutions, while others may be present in excessive quantities without depressing ammonification. The usual methods of determining nitrates in soil were found not wholly reliable in the presence of large quantities of soluble substances, either humus or salts.

The stimulating influence of arsenic upon the nitrogen-fixing power of the soil appears to be due to a number of factors. Arsenic directly stimulates the activity of some forms of Azotobacter. It was shown that arsenic liberates phosphorus when applied to soil and that it may act as a stimulant when applied to the soil in percentages which would be toxic in the solution. It was found that 10 parts per million of water-soluble arsenic added to the soil stimulated nitrogen-fixing organisms in all types of soil under study. Attention is also being given to a study of the influence of iron, manganese, sodium, magnesium, calcium, and potassium in various forms upon ammonification.

The study of the life history of the wheat-straw worm was continued at Cache Junction in a dry-farming area, and survey work was done by way of more completely outlining the areas in which infestation is severe. The insect appears in serious numbers only under dry-farming conditions. The reason for this is not yet apparent. Crops from very early and very late planting suffer most. It has been found that fall plowing is quite effective in reducing the injury from this pest.

Work on sugar-beet insects was largely confined to the sugar-beet leaf hopper. This pest was present in nearly every part of the State in unusual numbers in early spring. The infestation was perhaps the most serious that has been reported in the State. A long

cold period which followed an exceedingly warm period in early March greatly reduced the numbers of the leaf hopper. Some irrigation experiments were undertaken to ascertain the effect of continued moist conditions upon the prevalence of this pest. The application of irrigation water proved to be quite effective if done sufficiently early in the growth of the crop.

Further work was also done on grasshoppers, and this phase of the project was practically completed. Detailed records were made of the breeding habits of various species of grasshoppers, particularly *Camnula pellucida.*

In the poultry work of the station the project on the improvement of egg production by breeding and selection was actively continued. The original flock of the year 1907 are still producing and promise to continue egg laying for a number of years. In this work three strains of White Leghorns have been selected and have been under continuous observation for four years. Records are kept of each fowl, and these data will be used as a basis for future selections. The six flocks of hens under observation in this experiment range in age from 1 to 7 years. They are all descended from a small number of individuals introduced into the poultry plant about 10 years ago.

The average productive life of the fowls appears to be about 4 years.

It has been found that nearly all of the longer lived hens of the flock will lay more than 500 eggs, with individual records running up to nearly 1,000 eggs. The difference between the highest and lowest records in a flock has averaged 170 for the first year and 182 for the second year. The records kept during the course of this work indicate that a 3-year average is the most reliable index of the value of the individual hen.

As a basis for further work in studying artificial incubation of eggs much attention was given to the construction of a closed-circuit incubator in which air, moisture, carbon-dioxid content, and temperature may be accurately controlled. For this purpose an electrically operated and controlled machine has been constructed. Preliminary tests indicate great accuracy of the recording instruments and of control. The method of transferring heat to the incubator has been modified by increasing the circulation, thus obviating some of the difficulties encountered in the previous model.

Work with Hatch and other funds.—The animal-husbandry department carried on a study of the value of corn silage in dairy rations. From the results obtained in this experiment it was calculated that 3.1 pounds of silage may be used to replace 1 pound of hay. In a feeding experiment to learn the value of tankage for hogs it was found that 407 pounds of grain are required to produce 100 pounds of gain in rations containing tankage, while without tankage the hogs

made 100 pounds of gain for every 403 pounds of grain. The comparison of first, second, and third crops of alfalfa hay for milk production was continued. It is expected that the results of this test will soon be presented in bulletin form.

The agronomy work of the station included breeding experiments with potatoes and sugar beets, alkali studies, and experiments in irrigation. An improved strain of potato, especially well suited for local conditions, has been produced, Breeding work with sugar beets has yielded quite superior strains of seed. Some of these pedigreed stains are being distributed for cooperative test on a large scale. Some of these strains have proved to be considerably better than imported seed. Further work on alkali indicated that where water was added to the soil from above in large quantities practically all the alkali salts were carried to the lower levels, while when water was applied below and allowed to evaporate from the surface of the soil practically all the alkali salts were carried to the surface and deposited for the most part in the first inch of soil. Experiments were also continued in the application of irrigation water to wheat, sugar beets, and alfalfa. It was found that evaporation is not proportional to the initial percentage of water in the soil and is not directly proportional to the velocity of wind except within narrow limits.

The highest yield of corn per acre was produced with an application of 15 to 30 inches of irrigation water. Under the climatic conditions which prevail at Greenville it is considered that 20 inches is perhaps the optimum amount to apply. The use of 40 inches of irrigation water caused a diminution in the yield of corn.

The botanical department continued its study of Rhizoctonia disease in potatoes. Gratifying success was attained in combating this disease by the use of corrosive sublimate. A study was made of the cause of failure in farm practice in using this remedy. It was found that each sack of potatoes dipped into the solution removed a large percentage of the corrosive sublimate. In some instances it was found that each lot of potatoes placed in the vat removed from 20 to 30 per cent of the total amount of corrosive sublimate. Subsequent lots of potatoes placed in the same vat were therefore subjected to only a very dilute solution. The other botanical work of the station included a study of California peach blight and blackleg of potatoes.

The horticultural department continued its experiments in summer pruning. The results thus far obtained indicate that the yield of fruit is not increased by pruning trees in summer. Further observations, however, will be made on the same trees. Rather elaborate records were made of the minimum temperatures of fruit districts

This study showed that there is a very constant variation in minimum temperatures between different locations with respect to altitude. An average variation of 10° between the upper fruit levels and the bottom of the valley was noted. Depressions were found to be always colder than level areas at the same elevation. The effect of different amounts of water on the development of roots and tops of trees was carefully studied. Within certain limits it appears that increased quantities of water cause a greater spread of top and a deeper growth of roots. The horticultural department also began in cooperation with the department of meteorology an extensive study of the effect of different temperatures on buds and branches of fruit trees.

Aside from its Adams fund projects the entomological department continued a study of insect pests of alfalfa seed. It was found that in Emery County, where most of the work was carried on, intensive fall cultivation at about the time of the first fall frost tends to diminish the numbers of thrips and chalcis and that cultivation following the first cutting gives essentially the same results. Observations thus far made indicate the desirability of removing the first cutting as soon as possible. Much attention was given to the alfalfa weevil, which appears to be still spreading slowly in the alfalfa district. Plans have also been laid for a careful study of the apple leaf-roller.

In addition to miscellaneous and routine analyses in cooperation with other departments of the station the chemical department made a study of the quality of home-grown versus imported wheat. As a result of five years' observations it is concluded that wheat grown under dry-farming conditions in Utah does not diminish in quality. The 5-year average protein content of the home-grown seed was found to differ only by 0.1 per cent from that of the original seed.

The following publications were received from this station during the year: Bulletins 132, Minor Dry Land Crops at the Nephi Experiment Farm; 133, Irrigation and Manuring Studies; 134, The Nitric Nitrogen Content in the Country Rock; 135, A Study in Annual Egg Production, Based on the Records of a Flock of Seven-year-old Hens and Their Progeny; 136, The Commercial Production of Sugar-beet Seed in Utah; 137, The Quality of Home Grown *v.* Imported Wheat; 138, How to Control the Grasshoppers; and Circular 17, The Number and Distribution of Licensed Stallions and Jacks in the State in 1913—Being the Second Biennial Report of the State Board of Horse Commissioners.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	14,081.62
Farm products	2,696.88
	46,778.50
Miscellaneous (deficit)	263.81
Total	46,514.69

The Utah station is making satisfactory progress in all departments of its work. The work of the station is more and more appreciated by the farmers of the State, and local support is increasing both for scientific and practical features.

VERMONT.

Vermont Agricultural Experiment Station, *Burlington.*

J. L. Hills, Sc. D., *Director.*

Little new work was entered upon during the past year, but the progress made on the well-established lines of study was indicative of the benefits resulting to the station through the organization of extension work in the agricultural college. Changes in the station staff included the resignation of G. C. Cunningham, associate plant pathologist, to become plant pathologist of the Maritime Provinces, Canada, the appointment of May O. Boynton as librarian, and of W. H. Crockett as station editor. Shortly after the close of the fiscal year H. E. Bartram was appointed assistant plant pathologist to fill the vacancy caused by the resignation of G. C. Cunningham. The station library was put in shape, and a considerable amount of scientific apparatus was acquired for use in certain research problems. Only one line of cooperative work, the breeding of Morgan horses in cooperation with the Department of Agriculture, was pursued, but at the close of the year arrangements were made which allowed the station to withdraw from this enterprise.

Adams fund projects.—The investigations on the forcing of plants with carbon dioxid were continued with special reference during the past year to cyclamens, nasturtiums, and strawberries. Most of the work was done in the greenhouse, although considerably hindered through lack of space, but tests were also made out-of-doors to check up the results. Certain phases of the project which related to beans, peas, and potatoes, and studied principally the year before, were brought to completion.

The data thus far secured in the studies on the nutritive value of milk were summarized during the year and placed in manuscript form for publication. The results were studied with a view to ascertaining,

among other things, the influence of the percentage of fat on the condition of the pigs used in the experiments and the effect of feeding lime on the strength of the skeleton. The conclusions deduced from the large mass of data secured indicated interesting and valuable facts considered applicable not only in animal feeding but also in the field of human hygiene.

The accumulation of data in the study of the effect on the milk flow of feeding different amounts of protein to dairy cows for a long period was discontinued, and the results were brought up to date, preparatory to publication. Experiments were conducted in this connection for eight consecutive years, and, in addition to a study of the effect on the milk flow, they also included a comparison of results secured when the rations under test were used during long and short periods. The results suggested the desirability of obtaining data on the effect of a ration extremely low in protein, and the investigation is to be continued with this end in view. The studies of maintenance rations for dairy cows, the nutrients required for fetus development, and the food cost of metabolism were continued as recently outlined.

The investigation on the storage of carbohydrates in the maple and other trees was further pursued, and studies were made of maple sap and sirup in their relation to the problem. The source of samples was limited the past year to 12 orchards, and 75 analyses were made in connection with the investigation. Weather conditions did not favor the flow of sap, and this in a measure interfered with the work.

The study of the stimulating effect of Bordeaux mixture was continued under carefully controlled conditions in the greenhouse and also on potted plants in the open. The results obtained further indicated that the control of tip burn is the main factor in the increase of yields from sprayed plants. The increase in transpiration in treating plants was also confirmed. The data on the fungicidal effect of Bordeaux mixture were summarized to date, and the matter was written up at the close of the year.

Work on potato scab, on which Bulletin 184 of the station was issued early in the year, was conducted along special lines in an effort to account for the difference in resistance among varieties and to determine the relative efficiency of methods of control.

In studying the fusarium wilt of peas and asters much difficulty was encountered in successfully inoculating plants in the open air, while under greenhouse conditions the disease was readily produced. This led to experiments to ascertain the best conditions for infection, but it is realized that much remains to be done to determine these conditions fully and definitely.

The investigations on the tolerance of forest trees were pursued actively during the year with special reference to the modifying influence of various kinds of artificial shades on the physical factors,

including evaporation, soil temperature, air temperature, humidity, light, and wind as affecting the germination and development of tree seeds and seedlings respectively. The data were determined in all cases where possible by means of recording instruments. Different habitats also were studied in their relation to the development of seedlings.

In the study of plant breeding with the violets and blackberries of Vermont collections were made in several parts of the State, and numerous crosses were made between many species. Some fruit were developed, and a few seedlings were produced. The hybrids were studied to determine whether or not they would break up into different forms during the next generation.

Work with Hatch and other funds.—A number of other lines of work in addition to those already mentioned were carried on in the various departments of the station. At the request of the associated breeders of the State the station superintended and vouched for the advanced registry records which were financed from private sources. This work has now been put in charge of a college instructor who is made responsible for its conduct. Fertilizer-control work, the inspection of commercial feeding stuffs, seed analyses, the examination of creamery glassware, and the licensing of creamery operators also continued to form an important part of the station's activities.

The chemical department continued to give attention to the determination of the quality of organic nitrogen in commercial fertilizers, the organic being separated from the inorganic portions, and the results obtained in the original analyses confirmed. Much work was also done in ascertaining the lime requirements of soils in different parts of the State, using the calcium-acetate method devised at the station. A series of pot experiments was conducted in the greenhouse to determine the effect of soil organic matter and lime on the early growth of alfalfa.

The forester pursued further the problem of determining the factors influencing the rapidity of cell division in the cambium layer of white-pine trees, and a series of experiments in the greenhouse were entered upon for the confirmation of certain deductions. Attention was also given to forest planting as an investment, the red rot of conifers, and the reproduction of forest trees under natural conditions.

The department of horticulture gave further attention to the use of Bordeaux mixture as a fungicide, the value of hardwood sawdust in packing apples, and the selection of scions from trees of superior and inferior fruiting habits. Progress was made during the year on the productivity experiments with Hubbard squash. The influence of cross and self-fertilization on production and on the fertility of the seed was studied, and observations were made on the effect of selecting continuously for high and low yields. Inquiry was also directed

as to the factor or factors determining the character of wetness or mealiness in the squash. Experiments with strawberries embraced a study of high and low yields in terms of numbers of berries and weight of fruit and the effect of stolon formation on present and future fruit production.

The plant pathologist prepared an article on winter injury to fungi based on the results of studies made by him, which was published in the Journal of Agricultural Science.

The study of infectious abortion in cows was continued by the veterinarian. The administration of one-half ounce of methylene blue daily for a period of four or five weeks proved more satisfactory than the interrupted plan of treatment advised in Bulletin 174. Less than 5 per cent of all the reacting cows experimentally treated with methylene blue during the past three years aborted, as compared with 30 per cent of untreated control animals. In further resistance tests upon strains of *Bacillus abortus* which had previously shown unusual resistance to plain methylene blue it was found that the addition of cresol seemed to increase greatly the efficiency of the methylene blue as a bactericide for such strains, and this combination was employed upon most of the reacting cows experimentally treated during the past year. Investigations bearing upon the nature of blood complement begun about two years ago were pursued during the past year by the assistant veterinarian.

The publications received from this station during the year were as follows: Bulletins 175, Studies on Club Root—I, The Relation of *Plasmodiophora brassicæ* to Its Host and the Structure and Growth of Its Plasmodium; 176, The Management of Second-growth Hardwoods in Vermont; 177, Large Seed a Factor in Plant Production; 178, Studies in Tolerance of New England Forest Trees—I, Development of White Pine Seedlings in Nursery Beds; 179, Disease Resistance of Potatoes; 180, Commercial Feeding Stuffs—Concerning Feeding Practice; 181, Studies in Tolerance of New England Forest Trees—II, Relation of Shade to Evaporation and Transpiration in Nursery Beds; 182, Commercial Fertilizers—Irrigation; 183, Agricultural Seed; 184, Potato Scab; 185, Studies of Clubroot—II, Disease Resistance of Crucifers—Methods of Combating Clubroot; 186, Farm Apple Storage; 187, Flora of Vermont; 188, Forest Planting in Vermont as an Investment; and the Annual Reports for 1913 and 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	5,736.78
Fees	2,957.49
Total	38,694.27

The Vermont station has in progress numerous lines of work of great importance to the agriculture of the State, and its endeavors have the approval of the farmers generally. The relations between the activities of the college and the station have been measurably improved, as has also to some extent the financial status of the station, but it is still in great need of a regular State appropriation for its work, that received being largely for printing.

VIRGINIA.

Virginia Agricultural Experiment Station, *Blacksburg.*

W. J. Schoene, M. S., *Acting Director.*

The policy toward the station remained unchanged during the year, and its administration was continued under the State entomologist as acting director. Additional land was set aside for investigations in orchard work and in work with small grains. A part of this land was used in the project on fruit-bud formation. Further extension was made of the cultural experiments with alfalfa at Blacksburg and at several of the substations. The State appropriation for use in connection with the substations was $16,000. T. B. Hutcheson succeeded Lyman Carrier as agronomist, and W. K. Brainerd resigned his position as animal husbandman. H. S. Reed, plant pathologist, resigned and was succeeded by F. D. Fromme.

The results obtained in rotation experiments on the substations were of sufficient importance during the year to serve suggestively in changing many farm practices in the neighborhood in which these substations were located.

Adams fund projects.—The study of the effect of soil environment on fruit-bud formation was more thoroughly organized and was prosecuted actively. Much attention was given to the study of the effect of pruning upon the formation of fruit buds. It was found that spring pruning of the branches of trees at the time of growth resumption tends to diminish the activity of fruit-bud formation. Pruning during the latter part of June appeared to check the growth of the wood during the season and to stimulate greatly the formation of fruit buds, as shown by the crop of the following year. Pruning in the fall did not materially influence the number of fruit buds, but caused a vigorous growth of wood during the ensuing year.

The effects of root pruning, ringing, and stripping are not yet sufficiently well known to allow the formation of practical rules for the guidance of fruit growers. Experiments in apple breeding were continued, attention being given chiefly to the establishment of a late-blooming group of apples. Many additional crosses were made, and a considerable amount of hybrid seed was thus secured.

In the study of the protein and energy requirement for milk production the data accumulated during the past three years were

summarized. The feeding period was increased from 75 to 150 days, with three digestion periods of 10 days each. The effect of the different rations is measured by determining the content of sugar, fat, and protein in milk and the quantity of milk produced. The project is carried on cooperatively by the departments of chemistry and animal husbandry.

Interesting results were obtained in the project on the effect of green manuring upon the soil. It was found that the organic matter of bluegrass, clover, and alfalfa when plowed under gives rise quite rapidly to nitrates. The nitrification of the organic matter is more marked in sterilized than in unsterilized soils. The total number of bacteria in soils treated with green manures was much greater than in those which received no green manure. The highest bacterial count usually occurred in plats upon which legumes were grown. It was also found that the rate of nitrification was greatly increased by the presence of green manures. Incidentally it was learned that soils vary greatly in their power to accumulate nitrogen. The study of the fixation of phosphoric acid by soils was continued, but the results obtained during the year have not yet been summarized.

The investigation of the relations of parasitic fungi to their host plants was concerned during the year largely with a study of the nature of the chemical changes produced by digestive enzyms of fungi. This work was confined largely to apple bitter-rot. The culture media in which the fungus causing this disease was grown were carefully examined for the presence of cleavage products of proteins. During the course of the work lysin and certain purin bases were found. It appears that the process of autolysis in this fungus attacks the proteins of the fungus mycelium.

Satisfactory progress was made in the study of nitrogen fixation and nitrification in different soil types. A large number of organic compounds were used in experiments to determine their effect upon the growth of Azotobacter. In these experiments particular attention was given to the question whether these organic substances are deleterious to bacterial growth. The results of this study indicate that fixation of nitrogen by Azotobacter is only slightly influenced by these compounds. The compounds included vanillin, cumarin, pyrogallol, caffein, asparagin, etc. In studying the question of nitrogen fixation and nitrification in various soil types an effort was made to determine the effect of lime and sand upon these processes. It was found during the course of the work that a large increase in nitrates occurs under the influence of lime, while sand failed to stimulate nitrate formation in clay soils.

Work with Hatch and other funds.—Experiments with pasture grasses were continued, partly in cooperation with this department. Some comparative tests were made of new seedlings versus old sod.

It appears that from repeated close clippings of grass in the pasture plats a lower yield of hay is obtained, but that the hay contains a higher protein content. The effect of the association of legumes and nonlegumes received further attention. It was found that no direct benefit appeared from the association of bluegrass and white clover, at least in pot experiments. No increase in protein was found to result from the association of red clover and timothy. When corn and beans were grown together, the corn was somewhat benefited by the association. The results indicate that immature plants have higher percentages of protein than more mature ones. A general study was made of the conditions under which alfalfa thrives best and of the actual status of the alfalfa industry in the localities where it has become established. It was found that liming is usually necessary for the best growth of alfalfa, even on limestone soils, and that August seeding is preferable to spring seeding.

Several rotation experiments, including fertilizers and green manuring, were conducted during the year, as well as a large number of variety tests of field and forage crops. One of these rotation experiments is carried on in connection with the growth of dark tobacco. A 6-year rotation has been adopted, including tobacco, wheat, mixed grasses and clover for two years, corn and cowpeas, after which the field returns to tobacco. Observations are being made on the effect of applying fertilizers to different crops in this rotation.

The horticultural work of the station included a study of inheritance in garden vegetables and ornamentals, a variety test of small fruits, experiments in orchard management, and observations on the control of fire blight and on winterkilling.

Considerable attention was given to the preparation of spraying materials, particularly nicotin extracts and arsenicals. It appeared from these experiments that at the current prices for tobacco stems and tobacco sweepings a nicotin extract could be prepared on the farm more economically than it could be purchased. Numerous analyses were made of tobacco stems, leaves, and sweepings, and tables were published showing the amount of each form of tobacco necessary to make sprays containing 0.5 per cent nicotin.

In a study of the effect of other elements in a mixed spray upon lead arsenate it was found that sodium and potassium sulphids dissolve more arsenic when mixed with lead arsenate than do lime and barium sulphate in spray solutions. When arsenate of lead is added to sodium or potassium sulphid it appears that a large percentage of arsenic goes into solution. Barium chlorid, on the other hand, retards the solubility of arsenic. This effect of the sodium and potassium salts upon the solubility of lead arsenate partly explains the burning of the leaves from spraying with mixed insecticides.

A large amount of work was done in plant diseases in addition to the Adams fund projects on these subjects. Miscellaneous observations and studies were made on the common fungus diseases of alfalfa, apple, bean, maple, peach, and potato. Particular attention was given to a study of the cedar-rust disease of apples. The life history and means of distribution of this fungus were carefully investigated, and numerous experiments were made with fungicides in attempts to control the disease. The spray materials which showed the greatest efficiency were Bordeaux mixture, iron Bordeaux, lime-sulphur, and copper-lime-sulphur.

The spores from the cedar apples were found to travel long distances through the agency of the wind, and for this reason the safety of orchards from infection of cedar trees varies according to local conditions. The one really effective means of controlling apple rust is found in destroying cedar trees. Since the cedar apples or galls are the structures in which the disease passes a considerable part of its life, the complete removal and destruction of the cedar apples before they become mature would also be effective.

In connection with the animal-husbandry work of the station some experiments were conducted in the use of silage for steers. Observations were also made on the value of various forage crops for hogs. An experiment in methods of wintering steers was continued. A technical study of ice-cream manufacture was carried on. As a result of this work it appears that smoothness and keeping quality of ice cream are closely connected, and that smoothness depends upon the fineness of division of the solids present in the ice cream. The finer the emulsion of the fats the better the quality of the ice cream and the longer it may be safely kept. The keeping qualities of ice cream also appear to depend much upon the stability of the mixture.

The publications received from this station during the year were as follows: Bulletins 205, Summary of Ten Years' Experiments with Tobacco; 206, Experiments with Dark Tobacco; 207, Alfalfa Experiments; and 208, Preparation of Nicotin Extracts on the Farm.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$14,997.32
United States appropriation, Adams Act	14,999.70
Balance from United States appropriation, Hatch fund	2.68
Balance from United States appropriation, Adams fund	.30
State appropriation	23,500.00
Farm products	3,800.98
Miscellaneous	234.62
Balance from previous year	1,522.47
Total	59,058.07

The large number of changes made in the staff of the Virginia station temporarily affected its work and general condition as well as

its management. The continuance of the station management under an acting director is not conducive to the exercise of an aggressive, constructive policy or the making of long-time plans, since that office is usually regarded as a temporary arrangement. The large and varied field open to the station calls for a clearly defined policy and a strong, active administration if the best interests of the State are to be met.

WASHINGTON.

Washington Agricultural Experiment Station, *Pullman.*

I. D. CARDIFF, Ph. D., *Director.*

The station staff was strengthened during the year by a number of appointments. Dr. F. D. Heald was appointed plant pathologist, A. L. Sherman assistant chemist, and F. W. Allen assistant horticulturist, vice W. J. Young, resigned. Under the support of State and contributed funds a new division of the station was created, to be known as the dry-land department, with headquarters at a branch station recently established at Lind. The work at this branch station will consist of the investigation of cereals, forage crops, tillage, rotation, and farm management. The appropriation to the station out of State funds was about $9,000. For the coming year the station will have an appropriation of $19,000.

At its session two years ago the State legislature provided for a State board of agriculture, of which the director of the station is a member, which has general charge of control work with feeds, fertilizers, fungicides, and insecticides. This relieves the station of the regulatory work which it previously had to do.

Adams fund projects.—Work on the project on Mendelism in hybrids of blackberries, and raspberries has been carried on since 1912. Crosses between the blackberry and raspberry were made at that time, and the resulting hybrids fruited during the year. An effort was made to secure self-fertilized plants, and some crosses were made. As soon as this generation of plants comes into fruit it will be possible to make the studies which have been contemplated with reference to leaf structure, and habits of growth.

In studying the winter desiccation of fruit trees a survey has been made in localities where the trouble occurs, and in this connection some soil studies have been carried on. No pathogenic organism has been found. The trouble appears on the twigs, but when these affected twigs are grafted on healthy trees the disease disappears. Some work has been done in growing young trees in soil with a minimum of organic matter, but no conclusive results were obtained. During the coming winter some of the young trees will be taken up and studied under carefully controlled conditions.

The project on the function of sulphur as a plant food received considerable attention, particularly with reference to oats, field peas,

wheat, and barley. Some of these plants received sulphur in the form of gypsum, and others pure sulphur, while a number of plants are left as checks. In the other series of pots the sulphur is being exhausted by continuous cropping. The results thus far obtained are in favor of the addition of sulphur in one form or another. In connection with these experiments analyses are made of the different parts of the plant. It appears that to some extent sulphur may replace phosphorus. There is some indication that the sulphur has a relation to the green color of plants. It occurs in the nodules of soy beans in as high a percentage as does phosphorus. It was calculated from the analyses of oats that only 12 crops of oats would be required to remove all the sulphur now present in the ordinary Washington soil.

In studying the baking qualities of flour the components of the flour are being separated, and bread is made from the residue. Bread has been made without gluten. When the method of water extraction is used the food of the yeast is removed to such an extent that the bread will not rise. Gluten mixed with pure starch has been found to produce bread which is very compact. When the water-soluble extract of wheat is mixed with wheat starch without gluten a good porous bread is obtained. Apparently the water-soluble ingredients of flour play a more important rôle than gluten in the fermentation of bread dough and in determining the volume and texture of the load.

The study of the influence of cultivation on the nitrogen content of wheat was conducted at Grandview under irrigated conditions, at Ritzville under extremely dry conditions, and at the main station. These soils have also been assembled at the station in wooden boxes, where wheat is being grown and temperature readings are made every day. The amount of nitrates in the different soils varies quite largely, and this offers a good opportunity to study the effect of varying amounts of nitrate upon the nitrogen content of the wheat.

Satisfactory progress was made in the study of the progressive development of the wheat kernel. Beginning with the flowering stage, microscopical studies were made at frequent intervals. In the young stages no cane sugar nor protein was present, but fructose and amino acids were determined. Apparently the gluten is not formed until the grain begins to dry and ripen. An attempt is being made to determine whether an enzym is connected with protein formation.

In the study of the metabolism of tubercle bacilli the first object aimed at is to cultivate the organisms in a medium free from fat. In this way it is hoped that a tuberculin may be prepared by preventing the synthesis of fatty and waxy materials. The tuberculin would thus be purified and could be made more effective. Synthetic media have been prepared which supply carbon in different forms,

with the purpose of securing a body which will not break up into compounds from which fats and waxes may be synthesized. A preliminary survey has been made in connection with a new project on an unnamed animal disease which occurs in the eastern counties of the State. This disease affects calves, goats, pigs, horses, and cats and appears to be associated with goiter.

Work on inheritance in cereals was concerned largely with the inheritance of 2-rowed and 6-rowed characters in barley, pubescence on wheat, color of the wheat kernel, hulled and hull-less qualities in oats, and the resistance of wheat to stinking smut. A number of rye-wheat hybrids were made, but it has not been determined whether these hybrids are fertile. Some study is also being made of the inheritance of the length of head and beards in wheat and of early and late ripening in oats. In barley color and hull-lessness appear always to follow the Mendelian expectancies.

The investigation of soil moisture as related to dry farming is concerned chiefly with the study of plant growth in relation to soil moisture. Determinations are being made of water requirements of various crops and of the factors which affect these requirements. The bearing of tillage on the conservation of soil moisture is receiving much attention. In this work soil samples are taken at frequent intervals to depths of from 5 to 10 feet. Moreover, at Grandview the work involves a study of the effect of different amounts of irrigation water upon the growth of crops. A special study is being made of the factors which affect the water requirement. This work is carried on in pure sand cultures with nutrient solutions of different strength. It appears that the crop changes somewhat the character of the soil solution. In field work on this project indications have been obtained that the benefit of summer fallowing is largely in storing nitrates rather than in conserving moisture.

The investigation of the life history of ground squirrels was transferred at the end of the year to other funds. The work on the biology of the Columbian ground squirrel had been completed, and a beginning had already been made on the Townsend and Douglass ground squirrels. It has been determined that these squirrels live at least to an age of 8 years, and large numbers of them have been kept under observation in cages to determine various points in their habits.

Most of the field work in connection with the project on tomato blight is carried on at Clarkston. Thus far the testing of varieties with reference to their resistance has led to no result. In preliminary experiments it appeared that the blight was a root disease due wholly or in part to the effects of *Fusarium orthoceras* and *F. oxysporum*, and that exposure to the sunlight and wind will increase the rate of transpiration to such an extent as to render the plants more susceptible. In later work it was questioned whether Fusarium of Rhizoctonia was the cause of the disease.

Work was continued on the study of immunity of insects to insecticides. The same strength of spray was applied in orchards in various parts of the State. The spraying material included several sulphur compounds and oil emulsions. After each spraying counts were made three times a week to secure data on the rate of death of the scale insects from different solutions at different localities. In this work more than 170,000 individual scale insects were carefully examined. It appears that differences in resistance are due, not so much to the strength of the spray, as to the locality where the spraying is done. The differences in resistance appear also not to be attributable to the condition of the trees, the water used in diluting the spray, or the comparative thoroughness of application. Apparently there is an inherent biological difference with respect to resistance in the insects at various localities. A study of the effect of parasitism on the host insect involved a detailed investigation of the physiological effects of the parasites of the cabbage aphis. This pest is commonly parasitized by *Aphidius piceus* and *Xystus brassicæ*.

Work with Hatch and other funds.—The division of horticulture carried on work in apple storage to determine the effect of the amount of moisture in the soil on the keeping quality of fruit. Studies were also made of cover crops for orchards and of potato varieties. Cooperative experiments were carried on in the improvement of prune orchards in Clark County in connection with numerous fertilizer tests. In the study of orchard pollination some attention was given to the relation of the number of seed to the size of apples, one-sidedness of the fruit, and other features.

The department of chemistry made numerous miscellaneous analyses in cooperation with other departments and made an investigation of methods of determining mono, di, and tri calcium phosphates. The other work of the chemical department was under the support of the Adams fund.

The division of agronomy carried on numerous variety tests of cereals and of corn for silage. The seed of certain improved varieties of corn was distributed to a large number of farmers. Variety testing of alfalfa was carried on with many strains of this plant. The rotation experiments which were started many years ago were continued. A variety of wheat was obtained which excelled all varieties thus far tested in both yield and quality. This variety also has the advantage of being relatively resistent to smut.

An investigation was made of fires and explosions which occurred in thrashing separators in the eastern part of the State during the summer of 1914. This work involved a study of weather conditions, amount of smut, the flashing point of oils and greases used in the machinery, the explosibility of smut under different conditions, and the speed and other features of the operation of the separators. As a

result of this investigation the conclusion was reached that the trouble was caused by a combination of contributing factors, chief among which were an unusally dry season and a large amount of smut. It appeared that ignition of this combustible material was brought about largely by discharges of static electricity from the moving machinery.

The division of botany carried on experiments in spraying for gooseberry mildew. It appeared that this disease could be controlled by the use of lime-sulphur spray and that American varieties of the gooseberry are much less susceptible to mildew than are European varieties. Much work was also done in variety testing for resistance to smut in connection with a study of the time of planting, the soil conditions, moisture, tillage, and other factors in the production of smut. It was found that when wheat which had been injured or broken in thrashing was treated with copper sulphate or formaldehyde, the germ of the wheat was destroyed to the extent of about 50 per cent. Attention is also being given to the relation of smut to soil infection in the hope of determining whether smut lives over the winter in the soil. The wind is also being studied as a possible factor in the contamination with the disease. Smut appears to be much worse on winter than on summer wheat.

The entomological work of the station, aside from the Adams fund projects in entomology, included experiments in the control of potato beetle, crickets, and root maggots on cabbage, cauliflower, onions, and other garden crops. The best success in controlling root maggots was attained when the plants were started in the fall, either in a seed bed or in the field, and transplanted in February or March. This method of handling gives the young plants a start over the root maggot so that they are not seriously injured. A 3 per cent emulsion of carbolic acid was found unsafe to use for preventing maggot attacks on onions.

The division of dairy husbandry conducted some feeding experiments on the relative value of beet pulp and corn silage for cows. It was found that cows would consume 6 to 8 pounds more beet pulp per day than corn silage. No difference was observed in the condition of the cows or in the amount of milk produced. The veterinarian studied the effect of injecting large monthly or small weekly doses of tuberculin into tuberculous cattle. These repeated injections appeared to have some therapeutic value.

The following publications were received from this station during the year: Bulletins 114, Tuberculosis: A Report of the Results of the Continued Injections of Tuberculin upon Tuberculous Cattle; 115, Studies of the Relation of Certain Species of Fusarium to the Tomato Blight of the Pacific Northwest; 116, The Quantitative Determinations of Mono, Di, and Tricalcium Phosphates and Their Application; 117, Report on Fires Occurring in Threshing Separators

in Eastern Washington During the Summer of 1914; 118, Twenty-fourth Annual Report, 1914; 119, First Annual Report, Department of Dry Land Demonstration and Experiment, for the Year Ending December 31, 1914; 120, First Annual Report, Bureau of Farm Development, for the Year Ending December 31, 1914; 121, Washington Wheats; Popular Bulletins 63, Swine Husbandry in Washington; 66, Onion Culture; 70, The Alfalfa Weevil (*Phytonomus posticus*); 71, Preparation of Fruit Exhibits; 72, Handling Apples for Storage; 73, Stinking Smut in Wheat; 74, Lice and Mice: Life History and Extermination; 76, Winter Egg Production; 77, Spraying Calendar for 1915; 78, The San José Scale Insect (*Aspidiotus perniciosus*); 79, Pruning; 80, Fire Blight; 81, An Efficient Alfalfa Ditcher; 82, The Yellow Blight of the Tomato; 83, Hints on Goose Culture; 84, Care of Brood Sow; 85, A Movable Hog House; 86, Turkeys; 87, Profitable Hog Feeding; 88, Wheat Silage; 89, Control of Tumbling Mustard; 90, Farm Manure: Methods of Preservation and Application; and 91, Essentials for Growth of Chicks.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$13,687.95
Balance from United States appropriation, Hatch fund	1,312.05
United States appropriation, Adams Act	15,000.00
State appropriation	32,826.04
Farm products, including balance from previous year	7,381.50
Miscellaneous	1,367.49
Total	71,575.03

The general condition of the Washington station is good, and its work is effective. By means of the division of labor and differentiation between lines of work, more attention was given to the research work of the station, with a consequent strengthening of the investigations. The outlying work enables the station to attack local problems and others which can not be studied at Pullman.

WEST VIRGINIA.

West Virginia Agricultural Experiment Station, *Morgantown.*

J. L. Coulter, Ph. D., *Director.*

The station conducted both its scientific and practical work in vigorous manner and with pronounced success. An appropriation of $200,000 was made by the State legislature for an agricultural building and girls' dormitory. The apportionment for these two purposes has not yet been made. The fund was given to the institution with the proviso that the county should donate a farm to the station. At present a farm of 230 acres about 3 miles from the station is under lease. The new farm which the station is to receive from the county had not been definitely selected at the close of the year, but will probably lie about 1 mile from Morgantown.

At the close of the year Director E. D. Sanderson resigned and Dr. J. L. Coulter was appointed in his place, taking up his duties on September 1, 1915. The appropriations received from the State legislature included $4,000 for horticulture, $2,000 for live-stock investigations, $1,000 for tobacco investigations, $1,000 for poultry work, and $3,000 for printing. The total State appropriation for the maintenance of the station during the year was about $21,000.

Adams fund projects.—Interesting results were obtained from the study of the management and feeding of hens as related to the vigor of the germ in the egg. This work was conducted largely along chemical lines. An apparatus was devised for use in an electrically heated incubator whereby each egg is placed in a glass tube through which the air can be drawn, and the amount of carbon dioxid given off can be accurately determined. A dozen eggs are incubated simultaneously, and the carbon dioxid is determined at frequent intervals. The quantity of carbon dioxid given off from the egg is taken as a measure of the growth activities of the embryo. The death of the embryo is indicated by the immediate diminution of excretion of carbon dioxid. An attempt will be made to correlate the subsequent growth of the chicks hatched in this experiment with their embryonic activity as shown by the excretion of carbon dioxid. The quantity of carbon dioxid given off during the last five days of incubation was found to be about five-eighths of the total amount excreted during incubation.

The study of the correlation between the lime requirements of soils and their bacterial activities was somewhat reorganized and given a more definite course. An attempt is being made to determine the minimum lime requirements of soils and to learn whether soil bacteria will show a reasonable growth without much lime. It appears that practically all the soils of West Virginia are acid. In this study the rate of nitrification and of ammonification, the numbers of bacteria, and the ability of legumes to grow under different conditions are noted.

In continuing a study of the effect of pressure on the enzyms the work during the year was confined largely to bacteria in milk. A number of experiments were tried in inoculating milk with pathogenic bacteria and then subjecting the samples to pressure. It was found that tubercle bacilli, either in culture media or in milk, would withstand a pressure of 60,000 pounds per square inch. Lactic-acid bacteria endured a higher pressure than any other group of organisms. The experiments indicate that 75,000 pounds per square inch is the lowest pressure to be relied upon for the sterilization of milk. Further experiments will be conducted to determine whether the method is a practical one for the treatment of market milk.

Work on the relation of temperature to insect life was continued with interesting results. These experiments involved 12 species of insects, including flies, tent caterpillars, cutworms, etc. Insects kept at low temperatures for long periods were found to develop faster on less total effective temperature than if kept at higher temperatures from the beginning of the experiment. It was also found that insects kept under variable temperatures developed more rapidly than when kept at a constant temperature equal to the mean of the variable temperatures. The apparatus which has been devised for use in these experiments appears to be very simple and effective.

In continuing the study of the pollination of the apple, Rome Beauty, which is apparently a self-sterile apple, was pollinated with 6 or more other varieties, about 1,000 Rome Beauty trees being used for this purpose. It was found in this work that Rome Beauty pollen would germinate in a stigmatic extract of the same variety, but that when Rome Beauty pollen was placed on a stigma of the same variety it seemed to cause a closing and hardening of the stigmatic tissue. Rome Beauty pollen on its own stigma required 96 hours to penetrate the pistil, while other pollen required only 24 to 48 hours.

The investigation of the physiological effects of pruning apple trees was continued actively. This work has now been in progress for five seasons. Samples of wood are taken from severely pruned, slightly pruned, and unpruned trees for analysis of constituents, and the results compared with the extent of fruit-bud formation. The pruning work has been done on six varieties of trees in five orchards in different parts of the State. It appears that heavy pruning of young trees during the dormant season retards growth more than does light pruning. Pruning in early summer apparently did not impair the vigor of the tree. Early bearing was not promoted by summer pruning.

In the investigation of apple rusts careful determinations were made of the quantities of infected apple leaves which fell under known condition. The effect of rust infection on the size and grade of the fruit was also determined by taking counts of apples and carefully grading the fruits. It appears that apple leaves are susceptible to rust only when young and that a serious rust infection is not likely to occur after the first week in June. A severe attack of rust results in deformed and smaller fruit and loss of vigor on the part of the tree. The disease may be controlled by spraying, but the destruction of cedar trees appears to be the only permanently effective means of control. Work on the project relating to cucumber mildew was greatly handicapped on account of the prevalence of drought and the difficulty of obtaining suitable material.

Work with Hatch and other funds.—The department of animal husbandry carried on numerous experiments under the support of

Hatch and other funds. The most economic returns from beef cattle were obtained when calves were born in the spring and the animals were marketed after three summers on grass and two winters on inside or outside feeding. A comparison of timothy hay and silage for steers gave results in favor of silage. An experiment was also in progress during the year in wintering ewes and in breeding Delaine-Merino ewes to different types of rams for wool production. The dairy work of the station included experiments in wintering calves of the dairy shorthorn breed. A live-stock survey of the State is being carried on, chiefly with reference to cattle. Among the other experiments in animal husbandry mention may be made of a feeding test with various forms of green forage for hogs and a test of the effect upon the offspring of breeding sows at different ages. Gape-worms occurred in an unusually serious infestation of poultry. It was found that this trouble could be controlled by the use of creolin in the drinking water at the rate of three drops of creolin to a pint of water.

The agronomy department carried on a comparative test of the hill and row methods in determining the yield of corn and conducted experiments with soy beans, cowpeas, Sudan grass, oats, and methods of pasture renovation. Extensive selection experiments were carried on with soy beans, oats, and wheat. An attempt is being made to find a legume which will grow with bluegrass without the use of lime. Other experiments in agronomy included variety tests with field beans, cultural experiments with buckwheat, and an attempt to separate pure lines of corn.

The soils department began a study of the station fertilizer plats in cooperation with the department of agronomy. The chemical department in addition to its Adams fund work was called upon to make numerous analyses of limestones, fertilizers, soils, forage crops, and other materials in cooperation with the other departments of the station.

The general work of the poultry department is largely of a commercial nature and is almost self-supporting. An attempt is being made to determine the cost of raising chicks to a broiler age, the value of green food, and the influence of the size of the egg on the vigor of the chickens. A poultry survey was made of Jackson County.

The horticultural work of the station was mostly of a cooperative nature and was carried on in various localities throughout the State. An experiment is in progress in selecting potatoes on the basis of the tuber unit. In variety tests with strawberries it was found that the range of variation was from 100 to 480 berries per plant. Selections are being made from these varieties for further propagation. Experiments in thinning apples gave no evidence that annual crops of apples

can be brought about by this method. The thinning proved profitable, however, on the immediate crop. Attention was also given to small fruits for home and commercial planting, and an orchard survey was conducted in Jefferson County.

Rather striking results were obtained in fertilizer experiments in peach orchards. In an experiment which has been in progress four years the yearly growth of trees fertilized with nitrate of soda has been double that of trees which received no nitrogen. The leaves were favorably influenced by nitrate of soda, both as to total area and as to vigor of growth. The number of fruit buds on the nitrate plats as compared with those on the no-nitrogen plats was as 76 to 60. The maturity of the fruit was delayed several days by the use of nitrate of soda, but the yield of the fruit was nearly doubled by the use of nitrogen.

The department of plant pathology gave much attention to the study of tomato diseases, and a large mass of data was accumulated regarding the mode of infection by these diseases and practical methods for controlling them. A survey was made of many orchards in which collar rot appeared, and various methods of treatment were applied in the control of this disease.

The following publications were received from this station during the year: Bulletins 146, The Effect of Pressure on Certain Microorganisms Encountered in the Preservation of Fruits and Vegetables; 147, An Orchard Survey of Jefferson County; 148, A Poultry Survey of Jackson County; Inspection Bulletin 3, Commercial Fertilizers, Inspection 1914; Circulars 8, The Wooden Hoop Silo; 9, Some Factors Affecting the Weight, Composition, and Hatchability of Hen Eggs; 10, List of Bulletins Available for General Distribution; 11, How to Care for the Little Chick; 12, Orchard and Garden Spraying; 13, The Use of Hotbeds and Cold Frames on the Farm; 14, Sweet Clover; 15, Apple Rust or Cedar Rust in West Virginia; 16, The Fertilizer Law and Rules and Regulations for its Enforcement; 17, The University Farm Garden; 18, Field Beans—A Profitable West Virginia Crop; 19, Growing Forage Crops for Hogs; 20, Soy Beans—An Important West Virginia Crop; and the Report, 1913–14.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States Appropriation, Adams Act	15,000.00
State appropriation	21,000.00
Fees	15,713.53
Farm products	4,337.75
Balance from previous year	2,636.48
Total	73,687.76

The West Virginia station is in a more vigorous and satisfactory condition than it has been for many years. The improvement in the

organization of the staff and in the impetus to scientific work has affected not only the station, but also the agricultural instruction at the university, with the result that the university may now rely greatly on the agricultural work of the station in its appeal to the people for adequate support.

WISCONSIN.

Agricultural Experiment Station of the University of Wisconsin, *Madison.*

H. L. Russell, Ph. D., *Director.*

The affairs of the Wisconsin station were in a prosperous condition in all respects. The State appropriations to its work were generous, the total State fund for maintenance of the station for the year being about $96,000. A large publication fund is available, and from this fund $2,000 was set aside for the publication of research bulletins. The legislature provided for a commissioner of agriculture and added to the functions of the State department of agriculture. A part of the routine and control work of the station was transferred to the new department. Additional plats were provided at the station for the use of the department of plant pathology.

Adams fund projects.—In continuing the project on black rot, yellows, and blackleg of cabbage emphasis was laid chiefly on yellows. An effort is being made to secure strains of cabbage resistant to this disease. Rotation has thus far proved of no avail in preventing the disease. Yellows appeared in cabbage planted on land which had not been in cabbage for 14 years. Some highly resistant seed has been secured and is being further tested throughout the State and also in Washington. Work on the blackleg disease of cabbage was finished and the results are being prepared for publication.

The investigation of the mineral constituents of feeding stuffs and their importance in the growth of farm animals was continued actively. In this work pigs are fed an ash-free diet in order to note the effect of such a diet on growth, while other pigs receive a ration properly balanced with regard to its ash content. It has been found that 1 per cent of a physiologically balanced ash ration will insure growth, 2 per cent will enable reproduction, and 3 per cent will make possible the raising of young to the weaning age. On the other hand too large an amount of ash interferes with the process of reproduction. It was found that an ash-free and protein-free diet greatly reduced the elimination of chlorin.

Many interesting results were obtained in the comparison of nutrients from single plant sources with regard to their effect on the development of animals. Alfalfa hay proved to exercise a special diuretic effect upon cows, causing also a diminution in the flow of milk. Other diuretic agents were tested and it was found that urea produced the

same effects as alfalfa. The milk fat appeared to vary more than the other solids in milk. Studies on fats as carriers of the needed accessories for the growth of animals were continued. These studies have indicated that there is a substance in some fats which is essential to growth, while it is absent in others, but this substance has not been definitely isolated and determined. Rations which were fat free or contained lard as the only fat were deficient, but this deficiency was corrected by the use of butter fat or by an ether extract of egg yolk. Corn fat also appeared to be quite effective.

In studying the influence of the quality of proteins on growth it was found that the proteins of cereal grains have an efficiency of 20 to 25 per cent for pigs, as compared with milk protein with an efficiency of 60 to 65 per cent. It was also clearly shown that the quality of the protein in the ration is an important factor in the maintenance of cows and in milk production. Rations unbalanced with respect to the quality of the protein were found to interfere grealty with the process of reproduction in the cows. With pigs it was found that a strictly vegetable diet failed to produce growth after the animals had reached a weight of 100 pounds and had been on the diet about three months. The deficiency of the vegetable diet was indicated by stiffness, painful rheumatism, and other pathological symptoms.

In the study of methods of making cheese attention was directed to the determination of the question whether as good results can be obtained from continuous pasteurization as from other methods and whether under continuous pasteurization the rennet will act normally. The results obtained indicate that pasteurization may be widely used in cheese manufacture, provided the temperature used in pasteurization is not too high. The pasteurization method has been put into practice in several factories. It appears to increase the yield of cheese about 5 per cent and permits the handling of the milk by a smaller number of skilled men.

The effects of continued inbreeding were studied on poultry and rats. The results obtained from rats were not very satisfactory on account of the prevalence of pneumonia and other diseases. Inbreeding with poultry has been continued with old and young Rhode Island Red fowls. This work has now reached the third generation of birds. Deteriorations are particularly noticeable in vigor, fertility, and hatchability of the eggs.

Satisfactory progress was made in the analysis of hereditary factors which determine milk and meat production in cattle. Measurements and descriptions of the animals are taken at frequent intervals. A new building is planned for the herd of cattle used in this experiment, and this will add greatly to the efficiency of the project. The second generation of animals has now been reached and an effort is being made to follow closely as many characters as possible, including coat

color, hair, and fat globules. The Jersey and Angus breeds are used in this study.

The influence of soil treatment on the phosphorus content and the conditions influencing the availability of phosphorus were studied in connection with the growth of various plants, and eight different phosphates were used in this work. Marked differences were noted between different plants. It was found that rape and buckwheat would make three-fourths of normal growth on untreated rock phosphate, and similar findings were made with several other plants. It appears that plants which normally have a high calcium content have also a high requirement for rock phosphate. Colorimetric methods for determining small amounts of phosphorus were tested in connection with 18 types of soil. There appears to be some relation between the available phosphorus and the acidity of soils, phosphorus being less available in acid soils.

Work with Hatch and other funds.—The department of plant pathology conducted studies on cucumber diseases and the common diseases of potatoes, onions, barley, and other economic plants. In the study of onion diseases particular attention was given to smut and anthracnose. The latter disease has become so serious in some localities as to prevent the growing of white onions with profit. Onion smut may be controlled by formalin. It was found that barley smut could be largely prevented by soaking the seed in a formalin solution, in a ratio of 1 to 30, at a temperature of 20° C. Studies were also made on black rot, shed burn, and stem rot of tobacco.

A large amount of time has been devoted to methods of improving various types of soil. In connection with this work a soil survey of the State is in progress, and this survey is nearly finished for the northern part of the State. A new test for soil acidity was devised. It was found that when zinc sulphid was mixed with a soil sample hydrogen sulphid was given off if the soil was acid. This is considered as a more satisfactory test for soil acidity in practice than the litmus test. The presence of the hydrogen sulphid may be detected by the odor if it is present in any appreciable quantity.

The horticultural department continued its work in breeding tobacco, particularly with reference to resistance to root rot and other diseases. Spraying experiments were carried on in the northern half of the State, and observations were made on the winterkilling of fruit. An experiment was also in progress on root pruning of apple trees at planting time. Freezing experiments have been conducted in determining the root hardiness of the French crab apple. A great individual variation has been noted in this regard. A general survey of the status of strawberry culture in the State was made, and plans were suggested for the proper and authoritative certification of clean potato seed.

The most important research work on poultry is carried on in connection with the inbreeding project. The station is also studying the effects of rations for poultry and is breeding up a large flock of domesticated Mallard ducks.

The dairy work of the station was of a varied and extensive nature. It included a study of mottled butter, pasteurization of milk in bottles, sediment tests on milk, creamery methods for making buttermilk cheese, the improvement of various dairy tests, including ice-cream overrun test, a burette for calibrating Babcock test bottles, an attachment for the milk-sediment test, as well as problems connected with the disposal of creamery sewage, the organization and construction of creameries and cheese factories, the manufacture of whey butter at cheese factories, and the use of the tuberculin test in dairy cows. The cause of mottled butter was found in the uneven distribution of salt, which causes an unequal reflection of light. Some attention was also given to the problems of city milk supply.

In addition to its Adams fund projects on breeding the station carried on considerable other work in the field of animal and plant breeding. This work included studies of heredity in pigeons, the inheritance of oil in pure lines in soy beans, and the inheritance of disease resistance in flax and cabbage. A large amount of breeding work was also done on wheat. In this work both spring and winter wheat have been greatly improved in quality and yield. The study of pedigreed barleys was also continued. In this work a strain with high protein content has been produced. The breeding work with cereals is carried on in cooperation with a farmers' association, and meritorious strains thereby receive a wide distribution and a thorough test.

The study of sulphur as a plant food was continued, particularly with reference to its relation to the bacterial flora of the soil. It was found that phosphorus, especially in soluble form, stimulates the reproduction of soil organisms, while sulphur does not. It appears, therefore, that the benefits from the application of soluble phosphoric acid are to a considerable extent due to an increasing activity of the organisms of nitrification and ammonification. Sulphates were shown to have a highly stimulating effect on the roots of clover.

The bacteriological work of the station was carried on, partly in coperation with the chemical study of sulphur and phosphorus in soils, and partly in conection with the study of the effect of green manures on seed germination. It was found that the presence of organic matter under certain conditions favored the development of soil fungi, especially Rhizoctonia, which thereupon attack seedling plants. A large amount of bacteriological work was also done in connection with the by-products of organisms concerned in curing cheese, and in connection with the leucocytes and bacterial organisms

which are found in pasteurized milk. An elaborate study was made of the nitrogen cycle in three different types of acid soils. The presence of lime was found to be highly beneficial to the process of ammonification.

A number of feeding tests with farm animals were carried on during the year. One experiment involved a comparison of silage and roots for wintering ewe lambs. In another test alfalfa was compared with clover hay for the winter feeding of wethers. The addition of roots to a well-balanced ration for dairy cows slightly increased the milk flow, but the additional yield was not obtained at a profit. A comparison of whole versus rolled oats for horses gave results slightly in favor of the rolled oats. A general study was also made of the pork industry of the State.

The general subject of rural economics received much attention. Some of the investigations in this field were published in bulletin form. An elaborate study has been made of farm credit in Wisconsin, and of markets and prices for cheese, butter, and potatoes.

At the substations at Spooner and Ashland considerable work in agronomy and soil management was carried on. This work involved variety tests, breeding experiments, the comparison of rotation systems, and a study of the relationship of animal industry to practical farm management.

The following publications were received from this station during the year: Bulletins 239, Three Creamery Methods for Making Buttermilk Cheese; 240, Report of the Director, 1913; 241, Some Improved Dairy Tests and Methods; 242, Pork Production in Wisconsin; 243, What Has Been Done with the Tuberculin Test in Wisconsin; 244, Organization and Construction of Creameries and Cheese Factories; 245, The Disposal of Creamery Sewage; 246, Making Whey Butter at Cheddar-cheese Factories; 247, Farm Credit in Wisconsin—Amortization Schedule; 248, Strawberry Culture in Wisconsin; 249, A New Test for Soil Acidity; 250, The Year's Progress of the Experiment Station—Report of the Director, 1914; 251, Markets and Prices of Wisconsin Cheese; 252, Potato Seed Certification in Wisconsin; Research Bulletins 32, Black Rot, Shed Burn, and Stem Rot of Tobacco; 33, Comparative Efficiency for Growth of the Nitrogen of Alfalfa Hay and Corn Grain—The Comparative Efficiency for Milk Production of the Nitrogen of Alfalfa Hay and Corn Grain; 34, The Social Anatomy of an Agricultural Community; Circulars 47, Chemical Analyses of Licensed Feeding Stuffs, 1914; 49, Chemical Analyses of Licensed Commercial Fertilizers, 1913; 50, Distribution of Public Service Stallions Enrolled in the Counties of Wisconsin During 1914; 51, Social Surveys of Rural School Districts; 52, Control of Potato Diseases in Wisconsin; 53, Judging Draft Horses; 54, Hog-cholera Questions and Answers; and the Annual Report for 1913.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
State appropriation	96,215.00
Fees	12,250.00
Total	138,465.00

The Wisconsin station has fully maintained the high standard of its work in both practical and scientific lines. Its investigations and practical experiments cover a wide range of subjects, and in many directions its studies are especially adapted to the needs of the State.

WYOMING.

Wyoming Agricultural Experiment Station, *Laramie.*

H. G. Knight, A. M., *Director.*

The work of the Wyoming station progressed satisfactorily during the year without interruption or disturbance of any sort. A few internal adjustments in the staff were made necessary by leaves of absence granted to some members. Prof. A. D. Faville, animal husbandman, was absent during a portion of the year doing some advance work at the University of Wisconsin, and Dr. K. T. Steik was absent about six months for the purpose of carrying on some research work at Harvard University. An arrangement was made by which President Duniway will act as director for the coming year, in order to allow Director Knight to carry on advance work in certain phases of soil chemistry at the University of Illinois. The new agricultural building was occupied, and most of the necessary equipment for the building has been obtained. The facilities offered by this new building will add greatly to the convenience of the staff and are expected to result in more active work.

Adams fund projects.—In connection with the investigation of the strength of wool, a special chamber was devised and constructed for the control of humidity. This room provides an automatic control and recording of temperature and humidity. A large number of wool samples were tested, and results showed that up to a certain point the increase of moisture content lessens the strength of the wool fiber. Tests of the relation between breaking strength and area of cross section in wool fibers showed that usually the fiber does not break at the point of smallest cross section. It was impossible to continue work on comparison of fiber-testing machines for the reason that the desired fiber tester could not be obtained.

Distinct advance was made in the study of various range poisons. In the case of the woody aster an attempt was made to extract the active poisonous principle without the use of heat or organic solvents.

A thick tarry mass was obtained by the evaporation of an aqueous extract of green plants, and this material will be chemically examined.

In the study of larkspurs a glucosid was found in all the larkspurs under investigation. This glucosid bears an intimate relation to, or is a constituent part of, the alkaloidal principle of larkspurs. The investigation of the tall larkspur was practically completed. Plants gathered in September were found less toxic than those collected at other seasons. Similarly with lupines, an enzym was separated which acts readily upon amygdalin and therefore gives rise to the suspicion of a glucosid.

In continuing the study of the effect of alkalis upon structural materials, particularly cements, further evidence was obtained that the decrease in the strength of the cements is due, for the most part, to the solvent action of alkali waters. The alkali salts appeared to form more soluble compounds with cement than the compounds which were originally present. A beginning was made in the attempt to produce alkali-proof cements.

In the study of the method of transmission of swamp fever in horses the principal work during the year was on the possible agency of biting insects in carrying the disease. The evidence obtained in this work was to the effect that mosquitoes are not natural agents in transmitting the disease, but that biting flies, especially stable flies, may be such agents in transmission. For use in this work cages have been constructed capable of holding six horses and screened so as to exclude mosquitoes and flies.

Continued work on the life cycle of *Tænia expansa* indicated that lambs may become infected by having access to infected ponds or by running in an infected pasture free from water. Great difficulty has been experienced in determining the life cycle of *Thysanosoma actinioides*. Thus far experiments with the pond snail as a possible intermediate host have given negative results. In a study of the life history of *Sarcocystis tenella* it was shown that the presence of ponds or swamps favor infection. The evidence thus far obtained indicates that the sheep is not the final host of this parasite.

In the project on contagious abortion the work of the year resulted in the isolation of an organism pathogenic to rabbits and different from the abortion organism described by Bang. The disease was apparently eradicated from the station herd by treatment with methylene blue, supplemented by strict prophylactic measures.

More than 700 samples of milk were used in a study of the comparative merits of different methods of quantitative bacterial analysis of milk. The results of this study were not satisfactory in all respects. It appeared that the results obtained by any method depend quite largely upon the technique of the operator. The Slack method proved to be not so reliable as the ordinary plate method.

Work with Hatch and other funds.—The work of the departments of agronomy and animal husbandry is largely carried on with the support of Hatch funds, with cooperation of the chemical department. An elaborate series of crop-rotation experiments is under way to determine suitable rotation systems for Wyoming. In these rotation tests alfalfa, sweet clover, field peas, and various grasses are used. The use of stable manure showed a large increase in the yield of oats and barley. Some increase in the yield of cereal grains has appeared to result from the use of acclimatized seed. Of various crop combinations planted for forage purposes peas and oats gave the best results. Sweet clover was found to make a good crop in localities where alfalfa could not be grown. Corn proved to be a successful crop for silage or fodder at all altitudes below 5,000 feet. Experiments were also carried on in cultural methods for root crops, field peas, spring wheat, oats, mixtures for meadows and pastures, barley, miscellaneous forage crops, and potatoes.

The department of animal husbandry carried on experimental work along several lines, including the breeding of polled Herefords, a study of maintenance rations for breeding ewes, the use of oat and pea silage for horses and beef cattle, the fattening of lambs, and the use of silage in maintenance rations for range steers. In fattening lambs corn gave somewhat better returns than barley, and whole dry barley proved to be as satisfactory in lamb rations as soaked barley, cracked barley, or barley meal. In this work the chemical department cooperated, making numerous determinations to show the relation of plant composition to soil composition and determining the composition of feeds used in the experiments of the department of animal husbandry.

The botanical department made an ecological study of the changes of vegetation under irrigation. An elaborate series of observations were made on the order of plant succession which occurs when an indigenous arid-land flora is displaced by a meadow-land flora as the result of irrigation. The results of this investigation have been prepared for publication.

In addition to the Adams fund work in parasitology the veterinary department made a study of the problem of eradicating sheep ticks. It was found that if proper regard were paid to the thoroughness of the dipping operation, and if this were repeated at proper intervals, in connection with due precautions as to strict isolation of dipped and undipped sheep, the sheep tick might be completely eradicated in a single year.

The following publications were received from this station during the year: Bulletins 103, Corn *v.* Barley in Lamb Rations; Methods of Feeding Barley to Lambs; 104, Forage Crops; 105, The Eradication of the Sheep Tick; Index Bulletin E, List of the Bulletins and Annual

Reports by the Agricultural Experiment Station, and the Annual Report for 1914.

The income of the station during the past fiscal year was as follows:

United States appropriation, Hatch Act	$15,000.00
United States appropriation, Adams Act	15,000.00
Farm products	924.75
Balance from previous year	1,834.27
Total	32,759.02

In the quality and amount of output from its research work the Wyoming station is making a satisfactory showing. The policy of granting leave of absence for advance work at other institutions seems to have fully justified itself. The members of the station staff have eagerly availed themselves of the opportunity for improving their technical scientific training and efficiency.

STATISTICS OF THE AGRICULTURAL EXPERIMENT STATIONS.

The total income of the experiment stations, including the insular stations, during the fiscal year 1915 was $5,286,382.53. Of this amount $718,679.91 was derived under the Hatch Act, $719,699.66 under the Adams Act, $2,129,604.04 from State appropriations, $23,003.49 from individuals and communities, $343,087.66 from fees, $514,220.47 from farm products, and $716,466.87 from miscellaneous sources.

The value of additions to the equipment of stations was estimated as follows:

Buildings	$537,665.45
Libraries	40,544.05
Apparatus	130,754.74
Farm implements	85,768.13
Live stock	196,784.02
Miscellaneous	144,463.65
Total	1,135,980.04

The stations employed 1,857 persons in the work of administration and inquiry. Of this number 892 were also members of the teaching staff of the colleges and 466 assisted in farmers' institute and other extension work. During the year the stations published 1,676 annual reports, bulletins, and circulars, aggregating 30,867 pages, and these were distributed to 1,114,261 addresses on the regular mailing list.

The detailed statistics of the stations by States are shown in the tables following.

General statistics, 1915.

tation.	Location.	Director.	Date of original organization.	Date of organization under Hatch Act.	Number on staff.	Number of teachers on staff.	Number on staff assisting in extension work.	Publications during fiscal year 1914–15.		Number of names on mailing list.
								Number.	Pages.	
Alabama (College)	Auburn	J. F. Duggar	Feb. —,1883	Feb. 24,1888	25	14	18	22	191	25,500
Alabama (Canebrake)	Uniontown	L. H. Moore	Jan. 1,1886	Apr. 1,1888						
Alabama	Tuskegee Institute	G. W. Carver	Feb. 15,1897		15	15	15	7	66	1,700
Alaska	Sitka	C. C. Georgeson			8			1	96	
Arizona	Tucson	R. H. Forbes		1889	14	7	1	9	215	11,500
Arkansas	Fayetteville	Martin Nelson		1887	18	18	6	56	288	45,000
California	Berkeley	T. F. Hunt	1875	Mar. —,1888	127	65	36	28	719	26,085
Colorado	Fort Collins	C. P. Gillette		Feb. 29,1888	29	14	7	15	440	11,337
Connecticut (State)	New Haven	E. H. Jenkins	Oct. 1,1875	May 18,1887	20		6	8	653	9,600
Connecticut (Storrs)	Storrs	do		do	13	7	6	128	553	9,000
Delaware	Newark	Harry Hayward		Feb. 21,1888	11	9	9	8	305	7,300
Florida	Gainesville	P. H. Rolfs		1888	16		6	21	286	21,000
Georgia	Experiment	R. J. H. De Loach	Feb. 18,1888	July 1,1889	8			6	128	12,560
Guam	Guam	A. C. Hartenbower			3			1	27	
Hawaii	Honolulu	J. M. Westgate			9			9	271	
Idaho	Moscow	J. S. Jones		Feb. 26,1892	25	20	13	5	77	7,000
Illinois	Urbana	Eugene Davenport		Mar. 21,1888	100	65	40	34	866	33,000
Indiana	Lafayette	Arthur Goss	1885	Jan. —,1888	58			30	1,156	51,074
Iowa	Ames	C. F. Curtiss		Feb. 17,1888	47	17	1	20	714	31,896
Kansas	Manhattan	W. M. Jardine		Feb. 8,1888	80	34	34	19	421	19,504
Kentucky	Lexington	J. H. Kastle	Sept. —,1885	Apr. —,1888	53	20	12	54	1,180	18,000
Louisiana (Sugar	New Orleans	W. R. Dodson	Sept. —,1885							
Louisiana (State)	Baton Rouge		Apr. —,1886		30	3	6	10	381	10,000
Louisiana (North)	Calhoun		May —,1887							
Maine	Orono	C. D. Woods	Mar. —,1885	Oct. 1,1887	21			108	1,382	19,350
Maryland	College Park	H. J. Patterson	1888	Apr. —,1888	20	5	3	7	227	20,000
Massachusetts	Amherst	W. P. Brooks	1882[1]	Mar. 2,1888	36	8		37	592	28,432
Michigan	East Lansing	R. S. Shaw		Feb. 26,1888	36	20	16	11	333	30,000
Minnesota	St. Anthony Park, St. Paul.	A. F. Woods	Mar. 7,1885	1888	73	52		10	367	7,500
Mississippi	Agricultural College	E. R. Lloyd		Jan. 27,1888	25	9	8	7	102	25,000
Missouri (College)	Columbia	F. B. Mumford		Jan. —,1888	58	49	12	78	1,037	15,000
Missouri (Fruit)	Mountain Grove	do	Feb. 1,1900							
Montana	Bozeman	F. B. Linfield		July 1,1893	23	13	10	21	545	13,318
Nebraska	Lincoln	E. A. Burnett	Dec. 16,1884	June 13,1887	32	14		21	738	18,900
Nevada	Reno	S. B. Doten		Dec. —,1887	18	7	3	3	117	1,250
New Hampshire	Durham	J. C. Kendall	1886	Aug. 4,1887	19	13	13	7	340	16,500
New Jersey (State)	New Brunswick	J. G. Lipman	Mar. 10,1880		27	20	8	72	1,154	11,250

New Jersey (College)	do	do		Apr. 26, 1888	16	16				
New Mexico	Agricultural College	Fabian Garcia		Dec. 14, 1889	19	19	8	25	734	5,167
New York (State)	Geneva	W. H. Jordan	Mar. —, 1882		37		11	52	1,972	47,000
New York (Cornell)	Ithaca	B. T. Galloway	1879	Apr. —, 1888	52	52	30	188	1,981	85,000
North Carolina	West Raleigh	B. W. Kilgore	Mar. 12, 1877	Mar. 7, 1887	51	6	2	58	492	15,071
North Dakota	Agricultural College	T. P. Cooper		Mar. —, 1890	37		2	12	133	10,000
Ohio	Wooster	C. E. Thorne	Apr. 25, 1882	Apr. 2, 1888	63			29	1,443	80,000
Oklahoma	Stillwater	W. L. Carlyle		Dec. 25, 1890	22	17		16	333	9,000
Oregon	Corvallis	A. B. Cordley		July —, 1888	37	17		20	1,032	30,000
Pennsylvania	State College	R. L. Watts		June 30, 1887	67	65	34	84	1,802	45,000
Pennsylvania (Nutrition)	do	H. P. Armsby	1907						75	
Porto Rico	Mayaguez	D. W. May			8			6	193	
Rhode Island	Kingston	B. L. Hartwell		July 30, 1888	15	2		5	163	900
South Carolina	Clemson College	J. N. Harper		Jan. —, 1888	21	10	3	8	198	20,000
South Dakota	Brookings	J. W. Wilson		Mar. 13, 1887	18	14		11	250	23,000
Tennessee	Knoxville	H. A. Morgan	June 8, 1882	Aug. 4, 1887	23	6		13	145	12,000
Texas	College Station	B. Youngblood		Apr. 3, 1889	29	3		13	305	51,500
Utah	Logan	E. D. Ball		1890	22	11	1	6	208	13,000
Vermont	Burlington	J. L. Hills	Nov. 24, 1886	Feb. 28, 1888	17	7	3	9	486	15,000
Virginia	Blacksburg	W. J. Schoene [2]	1888	1891	22	10	5	11	455	13,000
Virginia (Truck)	Norfolk	T. C. Johnson			8		1	2	33	6,000
Washington	Pullman	I. D. Cardiff		1891	29	7	4	78	391	29,000
West Virginia	Morgantown	J. L. Coulter		June 11, 1888	34	17	19	18	613	13,000
Wisconsin	Madison	H. L. Russell	1883	1887	102	61	32	82	1,117	36,817
Wyoming	Laramie	H. G. Knight		Mar. 1, 1891	15	14	14	5	224	15,000
Total					1,857	892	466	1,676	30,867	1,114,261

[1] In 1882 the State organized a station here and maintained it until June 18, 1895, when it was combined with the Hatch Station at the same place.
[2] Acting director.

Revenue and additions

	Station.	Federal.		State.	Individuals and communities.	Fees.	Farm products.	Miscellaneous.[1]
		Hatch fund.	Adams fund.					
1	Alabama (College).	$15,000.00	$15,000.00	$27,000.00	.....	.....	$379.13	$6,061.99
2	Alabama (Canebrake).	.....	.....	.....	.....	.....	.....	.....
3	Alabama (Tuskegee).	.....	.....	1,500.00	.....	.....	.....	.....
4	Alaska	.....	.....	.....	.....	.....	2,375.33	5,447.78
5	Arizona	15,000.00	15,000.00	27,400.00	.....	.....	4,455.55	3,728.54
6	Arkansas	15,000.00	15,000.00	15,309.84	.....	.....	821.29	685.69
7	California	15,000.00	15,000.00	123,869.21	.....	$5,539.13	40,291.06	22,555.97
8	Colorado	15,000.00	15,000.00	22,794.72	.....	.....	3,339.44	5,829.64
9	Connecticut (State)	7,500.00	7,500.00	32,000.00	$9,153.49	10,400.00	49.50	1,771.33
10	Connecticut (Storrs).	7,500.00	7,500.00	4,500.00	.....	.....	3,968.64	1,196.01
11	Delaware	15,000.00	[2] 15,000.00	.....	.....	.....	5,638.47	.....
12	Florida	15,000.00	15,000.00	.....	.....	.....	1,301.92	694.48
13	Georgia	15,000.00	15,000.00	3,262.09	.....	.....	2,714.25	261.40
14	Guam	.....	.....	.....	.....	.....	274.57	273.64
15	Hawaii	.....	.....	.....	.....	.....	486.62	695.17
16	Idaho	15,000.00	15,000.00	10,136.75	.....	.....	10,303.89	4,082.70
17	Illinois	15,000.00	15,000.00	195,000.00	.....	.....	47,477.18	34,351.76
18	Indiana	15,000.00	15,000.00	91,000.00	.....	70,419.71	.....	195,885.36
19	Iowa	15,000.00	15,000.00	106,300.00	.....	.....	19,815.91	13,420.14
20	Kansas	[2] 15,000.00	15,000.00	76,318.74	.....	22,324.74	.....	.....
21	Kentucky	15,000.00	15,000.00	104,223.03	.....	70,521.06	56,590.09	14,536.07
22	Louisiana	15,000.00	15,000.00	24,291.70	.....	14,000.00	5,910.48	6,915.58
23	Maine	15,000.00	15,000.00	14,500.00	.....	12,288.75	16,450.31	.....
24	Maryland	15,000.00	15,000.00	10,674.70	.....	.....	10,078.27	1,376.78
25	Massachusetts	15,000.00	15,000.00	31,000.00	.....	9,892.00	2,377.00	26,876.23
26	Michigan	15,000.00	15,000.00	18,540.00	.....	6,160.00	1,537.24	3,492.78
27	Minnesota	15,000.00	15,000.00	207,093.90	.....	.....	92,462.91	1,844.86
28	Mississippi	15,000.00	15,000.00	24,549.25	.....	.....	5,483.04	13,109.83
29	Missouri (College)	15,000.00	15,000.00	20,260.01	.....	26,377.54	10,861.38	28,638.13
30	Missouri (Fruit)	.....	.....	.....	.....	.....	.....	.....
31	Montana	15,000.00	15,000.00	40,900.80	.....	.....	5,379.20	.....
32	Nebraska	15,000.00	15,000.00	45,933.40	.....	.....	.....	11,426.77
33	Nevada	15,000.00	15,000.00	1,000.00	.....	.....	78.50	3,165.01
34	New Hampshire	15,000.00	15,000.00	.....	.....	.....	1,199.17	8,103.12
35	New Jersey (State).	.....	.....	82,131.69	12,850.00	41,796.71	14,097.28	.....
36	New Jersey (College).	15,000.00	15,000.00	.....	.....	.....	.....	.....
37	New Mexico	15,000.00	15,000.00	.....	.....	.....	1,710.46	4,042.32
38	New York (State).	[2] 1,500.00	[2] 1,500.00	138,034.60	.....	.....	.....	15,310.40
39	New York (Cornell)	13,500.00	13,500.00	48,125.00	.....	6,820.00	.....	.....
40	North Carolina	15,000.00	15,000.00	.....	.....	.....	15,891.91	1,606.33
41	North Dakota	15,000.00	15,000.00	92,525.69	.....	.....	.....	16,830.24
42	Ohio	15,000.00	15,000.00	97,550.08	.....	.....	30,152.56	185,613.61
43	Oklahoma	15,000.00	15,000.00	5,000.00	.....	.....	3,022.44	1,360.04
44	Oregon	15,000.00	15,000.00	54,790.11	.....	.....	525.81	41,405.88
45	Pennsylvania	15,000.00	15,000.00	.....	.....	15,627.00	44,884.26	2,979.77
46	Pennsylvania (Nutrition).	.....	.....	.....	.....	.....	.....	.....
47	Porto Rico	.....	.....	.....	.....	.....	2,731.74	1,197.05
48	Rhode Island	15,000.00	15,000.00	.....	.....	.....	.....	6,784.57
49	South Carolina	15,000.00	15,000.00	14,922.88	.....	.....	2,247.76	154.90
50	South Dakota	15,000.00	15,000.00	12,000.00	.....	.....	15,167.63	9,707.32
51	Tennessee	15,000.00	15,000.00	22,042.63	.....	.....	7,529.10	899.24
52	Texas	15,000.00	15,000.00	89,763.78	1,000.00	.....	8,733.93	1,100.31
53	Utah	15,000.00	15,000.00	14,081.62	.....	.....	2,696.88	[4] 263.81
54	Vermont	15,000.00	15,000.00	5,736.78	.....	2,957.49	.....	.....
55	Virginia	[2] 15,000.00	[2] 15,000.00	23,500.00	.....	.....	3,800.98	1,757.09
56	Virginia (Truck)	.....	.....	.....	.....	.....	.....	.....
57	Washington	[2] 15,000.00	15,000.00	32,826.04	.....	.....	4,589.64	4,159.35
58	West Virginia	15,000.00	15,000.00	21,000.00	.....	15,713.53	4,337.75	2,636.48
59	Wisconsin	15,000.00	15,000.00	96,215.00	.....	12,250.00	.....	.....
60	Wyoming	15,000.00	15,000.00	.....	.....	.....	.....	2,759.02
	Total	720,000.00	720,000.00	2,129,604.04	23,003.49	343,087.66	514,220.47	716,466.87

[1] Including all balances, except from Federal funds.

[2] Including balance from previous year: Delaware, $300; Kansas, $5; New York (State), $0.36 Hatch. $0.04 Adams; Virginia, $2.68 Hatch, $0.30 Adams; Washington, $1,312.05.

to equipment, 1914–15.

Total.	Additions to equipment.							
	Buildings.	Library.	Apparatus.	Farm implements.	Live stock.	Miscellaneous.	Total.	
$63,441.12	$450.00	$590.00	$575.00	$300.00	$343.09	$590.00	$2,848.00	1
.....	.....	.....	.....	.....	.....	.....	.....	2
1,500.00	.....	.....	.....	150.00	.....	.....	150.00	3
[3] 47,823.11	1,626.73	29.75	106.05	2,577.80	450.00	602.29	5,392.62	4
65,584.09	160,838.42	17.70	494.08	606.58	50.00	1,471.25	163,478.03	5
46,816.82	3,936.00	225.00	3,512.00	84.00	1,515.00	1,441.00	10,713.00	6
222,255.37	12,181.19	2,101.11	4,729.68	3,129.26	20,090.14	4,117.79	46,349.17	7
61,963.80	3,562.86	372.78	778.73	787.10	100.00	.....	5,601.47	8
68,374.32	96.58	689.77	221.21	476.13	.....	2,230.95	3,714.64	9
24,664.65	.....	109.48	106.05	147.50	44.17	.....	407.20	10
35,638.47	499.90	113.38	378.90	1,538.50	2,071.20	444.39	5,046.27	11
31,996.40	4,132.72	595.76	372.43	600.00	.....	1,815.35	7,516.26	12
36,237.74	4,000.00	202.80	639.97	300.00	491.70	1,500.00	7,134.47	13
[3] 15,548.21	369.68	31.64	9.70	108.58	9.00	51.05	579.65	14
[3] 36,181.79	851.47	234.12	119.35	2,247.94	479.60	.....	3,932.48	15
54,523.34	1,342.54	87.95	969.83	1,031.50	2,587.87	361.90	6,381.59	16
306,828.94	17,107.27	50.03	5,056.37	7,205.44	5,235.73	3,119.67	37,774.51	17
387,305.07	21,188.88	1,955.83	1,713.89	3,040.46	55,926.00	3,395.14	87,220.20	18
169,536.05	3,160.03	40.50	716.96	1,034.74	481.40	10,875.00	16,308.63	19
128,643.48	11,031.22	270.78	1,754.17	4,739.88	18,672.89	10,788.26	47,257.20	20
275,870.25	6,000.00	1,500.00	2,000.00	1,400.00	500.00	2,000.00	13,400.00	21
81,117.76	2,000.00	199.16	1,595.61	1,448.09	4,025.61	.....	9,268.47	22
73,239.06	.....	710.61	231.85	1,188.37	.....	.....	2,130.83	23
52,129.75	.....	377.45	1,286.45	963.42	609.00	419.75	3,656.07	24
100,145.23	1,640.44	646.89	1,122.71	820.21	186.05	709.20	5,125.50	25
59,730.02	1,090.73	533.99	963.59	257.53	773.65	.....	3,619.49	26
331,401.67	10,850.00	5,624.69	37,087.43	4,524.10	15,084.23	14,874.36	88,044.81	27
73,142.12	500.00	50.50	264.42	4,104.00	7,890.53	845.70	13,655.15	28
116,137.06	2,873.17	23.63	2,325.28	981.82	4,565.10	.....	10,769.00	29
.....	.....	.....	.....	.....	.....	.....	.....	30
76,280.00	1,500.00	540.00	1,000.00	900.00	175.00	.....	4,115.00	31
87,360.17	11,500.00	1,210.00	1,115.72	416.92	5,175.00	.....	19,417.64	32
34,243.51	292.04	50.00	314.53	749.98	.....	196.39	1,602.94	33
39,302.29	.....	67.04	715.05	75.00	100.00	.....	957.09	34
150,875.68	1,077.04	104.05	1,778.47	1,723.08	1,107.01	275.00	6,064.65	35
30,000.00	1,005.32	324.43	125.13	239.02	.....	.....	1,693.90	36
35,752.78	310.64	91.38	668.68	1,090.86	.....	649.71	2,811.27	37
156,345.00	.....	1,200.00	3,850.00	1,725.00	.....	.....	6,775.00	38
81,945.00	90,000.00	6,430.00	14,516.00	3,579.00	4,162.00	10,571.00	129,258.00	39
47,498.24	7,700.00	188.90	1,193.28	350.00	.....	67.70	9,499.88	40
139,355.93	1,811.21	2,460.54	6,930.34	2,859.23	3,581.04	37,905.69	55,548.05	41
343,316.25	21,797.84	1,706.63	3,346.69	1,418.10	5,939.85	21,007.93	55,217.04	42
39,382.48	1,405.91	147.20	2,518.40	1,304.43	1,078.25	829.06	7,283.25	43
126,721.80	.....	508.00	1,675.28	2,246.85	7,511.72	.....	11,941.85	44
93,491.03	35,000.00	195.04	60.00	800.00	1,023.00	.....	37,078.04	45
.....	.....	217.80	633.43	.....	.....	.....	851.23	46
[3] 33,928.79	539.03	143.56	75.00	446.14	315.00	.....	1,518.73	47
36,784.57	742.12	598.08	155.95	25.00	.....	615.00	2,136.15	48
47,325.54	3,708.58	155.89	603.90	1,587.33	30.00	1,131.48	7,217.18	49
66,874.95	3,936.44	3.50	723.53	2,284.94	6,972.29	1,051.59	14,972.29	50
60,470.97	9,686.15	606.45	418.74	1,135.44	7,200.00	242.46	19,289.24	51
130,598.02	18,751.44	168.99	1,347.98	6,204.46	6,112.67	3,284.68	35,870.22	52
46,514.69	255.96	127.55	349.72	718.39	66.37	76.31	1,594.30	53
38,694.27	.....	470.72	2,251.93	89.87	80.00	128.90	3,021.42	54
59,058.07	1,919.09	259.50	552.99	1,718.17	362.00	.....	4,811.75	55
.....	.....	47.97	189.18	306.79	250.00	77.93	871.87	56
71,575.03	.....	651.00	418.00	513.00	40.00	.....	1,622.00	57
73,687.76	.....	350.00	2,450.00	135.57	.....	55.00	2,990.57	58
138,465.00	5,896.80	1,106.77	4,998.74	3,673.23	2,815.95	2,619.47	21,110.96	59
32,759.02	47,500.01	3,027.76	6,646.37	1,659.38	505.00	2,025.30	61,363.82	60
5,286,382.53	537,665.45	40,544.05	130,754.74	85,768.13	196,784.02	144,463.65	1,135,980.04	

[3] Including Federal appropriation: Alaska, $40,000; Guam, $15,000; Hawaii, $35,000; Porto Rico, $30,000.
[4] Deficit.

Expenditures from United States appropriation received under the act of Mar. 2, 1887 (Hatch Act), for the year ended June 30, 1915.

Station.	Amount of appropriation.	Classified expenditures.								
		Salaries.	Labor.	Publications.	Postage and stationery.	Freight and express.	Heat, light, and water.	Chemicals and laboratory supplies.	Seeds, plants, and sundry supplies.	Fertilizers.
Alabama	$15,000.00	$7,375.67	$2,275.28	$1,028.07	$363.75	$355.85	$611.00	$196.76	$550.56	$239.15
Arizona	15,000.00	7,696.31	1,880.18	432.67	1,351.10	223.42	447.05	7.98	669.14	153.42
Arkansas	15,000.00	9,623.83	687.84	847.84	420.39	390.00	54.93	95.13	330.62	3.75
California	15,000.00	9,699.96	2,550.17	2,140.57	47.28	10.25	10.05	63.00	110.18	19.00
Colorado	15,000.00	9,762.44	808.03	1,768.69	421.11	92.96	92.75	.....	205.74	.....
Connecticut (State)	7,500.00	7,374.64	104.90	.....	.....	.....	.....	.....	.....	21.36
Connecticut (Storrs)	7,500.00	6,971.40	451.10	5.50	1.55	.....	.....	4.01	18.32	7.00
Delaware	15,000.00	4,888.45	4,773.61	630.45	260.38	64.34	305.90	51.56	665.47	136.19
Florida	15,000.00	5,687.66	3,668.36	1,290.37	652.44	254.84	143.05	46.00	196.49	228.78
Georgia	15,000.00	7,647.88	2,471.47	1,047.75	518.86	193.05	287.21	.....	454.79	219.52
Idaho	15,000.00	7,640.16	3,162.41	349.04	465.40	106.34	351.23	143.75	577.13	.....
Illinois	15,000.00	12,153.19	953.13	550.47	109.70	55.52	.....	415.50	113.47	.....
Indiana	15,000.00	10,490.01	1,018.68	733.73	52.42	.87	132.72	3.75	90.41	.....
Iowa	15,000.00	7,760.00	780.56	1,294.93	25.14	7.05	44.10	244.53	494.87	2.50
Kansas	[1] 15,000.00	8,133.32	4,341.83	9.70	25.63	3.30	30.14	189.95	450.23	.....
Kentucky	15,000.00	10,380.84	719.14	1,114.45	530.82	41.89	433.03	278.60	177.66	.....
Louisiana	15,000.00	9,831.52	2,537.63	1,040.68	12.40	.....	.....	9.30	141.10	.....
Maine	15,000.00	5,537.01	3,664.04	113.87	717.20	139.05	158.75	180.29	325.06	1,375.36
Maryland	15,000.00	11,413.77	2,561.06	472.99	24.44	.....	.....	.....	209.74	318.00
Massachusetts	15,000.00	12,678.44	1,124.44	11.50	.....	.....	26.79	223.78	375.21	449.70
Michigan	15,000.00	9,639.60	2,019.74	49.00	193.67	25.98	123.92	639.83	624.58	31.55
Minnesota	15,000.00	8,966.68	6,033.32	.....	.....	.....	.....	.....	.....	.....
Mississippi	15,000.00	7,172.23	3,740.50	244.15	157.25	389.20	21.03	.....	955.71	.....
Missouri	15,000.00	11,215.79	1,361.14	1,252.63	260.54	.....	1.05	82.65	155.86	.....
Montana	15,000.00	10,750.00	1,861.36	385.30	479.00	57.90	41.62	94.53	402.09	.75
Nebraska	15,000.00	6,810.65	3,546.55	1,154.20	910.90	64.93	62.82	56.83	247.35	.....
Nevada	15,000.00	8,992.29	2,307.18	70.84	300.91	72.87	59.05	146.72	457.17	.....
New Hampshire	15,000.00	8,399.01	677.78	2,771.52	648.35	303.38	618.51	2.13	118.75	270.20
New Jersey	15,000.00	9,275.00	1,330.72	.....	734.39	80.84	819.13	497.62	239.15	181.70
New Mexico	15,000.00	6,646.70	2,888.33	1,373.08	188.05	131.26	170.15	2.55	325.16	198.43
New York (State)	[1] 1,500.00	1,233.25	194.87	.....	.....	.....	.....	.....	.....	.....
New York (Cornell)	13,500.00	6,390.45	2,898.23	141.60	639.09	170.47	.60	86.36	351.40	241.85
North Carolina	15,000.00	8,050.55	2,664.50	.....	365.84	435.29	109.70	.....	327.90	302.48
North Dakota	15,000.00	14,174.76	32.50	.....	.....	.....	.....	.....	.....	.....
Ohio	15,000.00	8,569.23	1,230.34	776.02	47.96	.....	.....	137.17	674.37	.....
Oklahoma	15,000.00	8,239.23	2,296.81	.....	355.47	138.12	10.20	245.10	414.72	42.50
Oregon	15,000.00	12,649.99	755.76	39.92	21.94	14.37	40.71	336.67	95.39	.....
Pennsylvania	15,000.00	9,782.15	2,220.25	2,205.26	212.15	98.41	1.60	35.33	4.59	.....
Rhode Island	15,000.00	6,419.54	2,983.62	1,619.65	239.27	172.31	88.24	34.48	362.40	919.32

South Carolina	15,000.00	7,045.20	3,564.34	1,151.51	240.05	147.45	74.83	.....	300.95	628.31
South Dakota	15,000.00	7,586.65	2,010.33	1,845.72	101.31	53.73	14.90	94.76	557.73	1.35
Tennessee	15,000.00	9,220.00	2,841.29	241.51	441.11	50.94	474.36	116.93	376.72	.....
Texas	15,000.00	9,833.13	2,416.11	.....	900.34	13.43	31.27	62.97	218.39	169.80
Utah	15,000.00	6,931.97	3,555.99	632.99	592.66	27.54	117.69	81.44	391.05	116.00
Vermont	15,000.00	8,350.88	1,651.67	609.92	411.16	124.34	766.72	432.68	326.14	260.64
Virginia	[1] 15,000.00	7,823.29	2,424.00	1,265.99	457.02	180.87	205.00	162.29	604.43	298.70
Washington	[1] 15,000.00	7,593.23	1,833.39	1,687.36	1,090 19	88.28	33.25	122.55	127.01	.....
West Virginia	15,000.00	9,437.08	1,405.65	.....	44.94	41.91	355.23	83.37	216.96	94.83
Wisconsin	15,000.00	8,758.00	2,487.67	.....	36.09	87.21	50.00	173.86	172.14	50.08
Wyoming	15,000.00	7,316.02	2,872.93	1,091.61	285.33	72.42	368.65	14.40	174.45	100.00
Total	720,000.00	426,039.05	108,639.83	35,493.05	15,955.09	4,982.18	7,788.93	5,897.11	15,378.75	7,082.22

[1] Including balance, as follows: Kansas, $5; New York State, $0.04; Virginia, $2.68; Washington, $1,312.05.

Expenditures from United States appropriation received under the act of Mar. 2, 1887 (Hatch Act), for the year ended June 30, 1915—Continued.

Station.	Classified expenditures—Continued.								
	Feeding stuffs.	Library.	Tools, implements, and machinery.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.	Buildings and repairs.
Alabama	$896.47	$404.84	$301.39	$53.15	$19.64		$44.08	$20.00	$264.34
Arizona	392.85	13.75	232.38	141.04	11.00	$50.00	1,283.08		14.63
Arkansas	1,179.70		75.07	328.60	154.63	76.22	228.77	20.00	482.68
California		.26	11.63	45.35	8.22		269.34		14.74
Colorado	3.19	340.94	163.09	203.30	170.46		316.52	20.00	630.78
Connecticut (State)									
Connecticut (Storrs)			1.61				39.51		
Delaware	1,668.04	97.96	139.30	117.98	6.12	571.20	142.80	8.25	472.05
Florida	1,709.34	482.82	240.44	34.67	18.37	7.00	105.32	20.20	213.80
Georgia	242.47	70.51	291.59	269.84	92.17	10.00	352.02	80.87	750.00
Idaho	1,399.71	5.25	308.77	81.90	107.78		148.49	20.00	132.73
Illinois		3.50	4.50	76.65	292.07		238.91	20.00	13.39
Indiana	1,475.13	23.24	1.50	72.15	23.68	299.50	278.20	20.00	284.01
Iowa	3,412.15		410.89	145.15	129.64	116.44	48.33		83.72
Kansas	59.85	172.50	179.99	45.15	749.13	254.25	251.98	35.50	67.55
Kentucky		769.48	15.06	258.81			27.69	20.00	232.53
Louisiana	790.43		89.25	26.82				20.00	500.87
Maine	1,018.96	619.07	211.36	93.12	16.20	4.50	353.30	20.00	452.86
Maryland									
Massachusetts		19.43	32.91			41.00	16.80		
Michigan	18.50	462.35	71.33	27.91	328.86	35.43	687.75	20.00	
Minnesota									
Mississippi	1,429.85	2.50	94.85	.40		250.00			542.33
Missouri	496.53		30.00		39.85	13.25	79.89		10.82
Montana	205.92	35.62	104.80	97.70	37.21	184.50	222.45		39.25
Nebraska	1,106.45	25.80	411.89	290.01	61.60		48.00		202.02
Nevada	26.05	96.69	908.14	254.20	194.73	63.50	523.25	20.00	506.41
New Hampshire	297.84	317.15	15.28	286.00	29.62	69.90	150.33	20.00	4.25
New Jersey	30.00	301.03	72.40	236.63	121.58		699.36	124.30	256.15
New Mexico	1,016.53	66.95	651.19	100.29	1.82	472.00	302.80	218.00	246.71
New York (State)			32.59					39.29	
New York (Cornell)	10.52	29.64	527.94	355.92	308.16		958.94		388.83
North Carolina	1,615.39		365.93	41.70			146.44	20.00	554.28
North Dakota			150.00						642.74
Ohio	1,201.44		1,393.27	47.90	172.30				750.00
Oklahoma	873.70	25.05	904.48	105.25	46.65	557.95	12.54		712.23
Oregon	644.56		13.35	33.70	233.60	48.00	52.04	20.00	
Pennsylvania	75.00	195.04	25.18	66.28	67.50				11.26
Rhode Island	488.74	566.95	62.04	119.40	25.87	14.00	115.04	20.00	749.03
South Carolina	1,090.87	60.65	278.59	152.50			106.70		158.05

South Dakota	824.24	3.50	403.43	457.85	319.30	254.90	17.35	.....	452.95
Tennessee	588.54	181.05	148.93	193.69	2.13	.....	52.21	20.00	50.59
Texas	107.40	140.72	149.80	381.27	89.00	234.53	321.20	20.00	310.64
Utah	871.73	34.19	341.94	29.08	103.92	48.00	1,045.21	15.00	63.60
Vermont	512.80	440.84	77.56	128.90	77.55	80.00	390.35	20.00	337.85
Virginia	368.71	254.80	401.84	30.53	163.74	.....	174.02	20.00	164.77
Washington	15.25	651.39	381.85	286.87	77.60	33.00	950.63	20.00	8.15
West Virginia	1,890.30	328.80	210.87	59.79	14.57	.....	860.70	.....	.....
Wisconsin	1,712.40	.....	471.18	4.62	940.06	45.20	11.49	.....	.....
Wyoming	2,155.02	18.11	408.48	4.25	54.40	.....	31.66	.....	32.27
Total	33,922.57	7,262.37	11,819.86	5,786.32	5,310.73	3,834.27	12,105.40	941.41	11,805.86

Expenditures from United States appropriation received under the act of Mar. 16, 1906 (Adams Act), for the year ended June 30, 1915.

Station.	Amount of appropriation.	Classified expenditures.							
		Salaries.	Labor.	Postage and stationery.	Freight and express.	Heat, light, and water.	Chemicals, and laboratory supplies.	Seeds, plants, and sundry supplies.	Fertilizers.
Alabama	$15,000.00	$10,737.50	$1,696.19	$82.76	$149.74	$410.52	$403.62	$252.71	$291.28
Arizona	15,000.00	11,318.76	2,039.25	184.19	155.91	34.72	165.86	217.71	106.45
Arkansas	15,000.00	10,830.15	976.02	46.67	97.67	206.64	263.16	335.71	3.00
California	15,000.00	10,061.51	2,070.15	77.44	43.19	26.55	524.18	342.13	30.70
Colorado	15,000.00	11,888.17	641.68	37.44	82.56	278.06	339.03	72.08	43.90
Connecticut (State)	7,500.00	5,171.96	681.39	65.41	67.58	500.76	488.73	112.78	57.70
Connecticut (Storrs)	7,500.00	6,351.43	904.08				20.25	191.72	
Delaware	[1] 15,000.00	10,169.91	439.68	42.05	69.59	124.89	902.83	325.63	100.14
Florida	15,000.00	11,791.81	795.66	25.96	123.45	172.29	584.95	283.43	41.99
Georgia	15,000.00	9,743.32	1,489.49	45.95	83.74	300.38	520.32	207.30	80.00
Idaho	15,000.00	8,993.30	1,658.52	173.93	322.14	195.79	961.20	468.58	
Illinois	15,000.00	12,387.12	1,341.95	26.52	12.88	16.76	154.04	21.98	
Indiana	15,000.00	12,255.01	352.26	45.56	3.12	136.80	443.47	83.60	
Iowa	15,000.00	9,535.53	1,771.59	30.65	192.73	113.40	996.24	582.27	34.14
Kansas	15,000.00	5,841.69	4,268.55	116.56	73.54	185.86	643.58	553.55	
Kentucky	15,000.00	11,863.07	561.80	19.04	34.98	140.77	425.92	155.11	
Louisiana	15,000.00	11,554.06	405.36	22.91	65.86	219.35	36.04	133.09	
Maine	15,000.00	11,049.60	33.03	144.72	99.58	168.00	269.74	264.04	
Maryland	15,000.00	9,959.40	560.23	117.04	109.07	338.67	116.00	170.49	63.22
Massachusetts	15,000.00	14,586.63	287.17				69.46	29.48	
Michigan	15,000.00	10,367.40	1,438.33	13.61			2,040.86	93.06	
Minnesota	15,000.00	13,689.16	1,310.84						
Mississippi	15,000.00	9,066.67	4,333.29	49.79	42.86	12.32	59.50	149.78	
Missouri	15,000.00	4,800.01	4,524.96	89.05	215.39	3.80	659.90	262.58	63.16
Montana	15,000.00	11,858.34	1,451.15	50.59	108.78	32.85	205.41	134.83	
Nebraska	15,000.00	11,077.49	1,563.00	60.83			718.10	274.67	
Nevada	15,000.00	11,108.83	137.27	76.50	183.02	247.67	914.47	497.43	
New Hampshire	15,000.00	8,444.03	3,643.82	10.86	26.31		275.61	304.22	149.98
New Jersey	15,000.00	11,145.83	1,830.63	9.60	7.10	232.07	193.45	211.88	59.85
New Mexico	15,000.00	8,715.82	1,483.19	86.97	235.36	561.83	240.42	244.10	22.62
New York (State)	[1] 1,500.00	1,500.00							
New York (Cornell)	13,500.00	9,123.10	3,194.88	14.53	24.98		657.26	81.79	
North Carolina	15,000.00	13,230.00	655.02	104.76	46.94	72.00	211.82	80.31	31.05
North Dakota	15,000.00	11,304.64	256.29	9.95	14.56		793.64	115.32	42.10
Ohio	15,000.00	7,946.79	1,421.04	19.37			2,223.45	499.97	
Oklahoma	15,000.00	6,931.65	1,762.96	14.50	206.06	78.38	1,146.36	260.61	
Oregon	15,000.00	12,191.65	110.25	10.53	97.77	315.96	916.26	244.84	
Pennsylvania	15,000.00	10,694.69	1,513.27	23.69	189.48	100.60	489.53	248.50	922.70
Rhode Island	15,000.00	8,411.68	3,683.67	73.21	70.84	344.81	221.13	369.51	7.50
South Carolina	15,000.00	8,998.48	3,090.87	184.53	45.18	195.30	602.90	332.97	57.00

South Dakota	15,000.00	9,645.00	2,616.72	.....	101.90	33.21	809.45	301.32	26.38
Tennessee	15,000.00	11,573.35	958.92	26.31	59.18	60.97	645.02	136.56	7.40
Texas	15,000.00	9,834.55	1,753.72	23.58	194.03	52.50	308.50	175.10	215.00
Utah	15,000.00	10,250.04	2,671.58	8.61	13.41	297.83	553.37	96.09	.....
Vermont	15,000.00	8,411.58	2,211.40	98.80	28.87	.....	372.85	424.06	7.00
Virginia	[1] 15,000.00	9,681.64	1,869.87	6.30	83.67	93.63	743.74	357.07	151.69
Washington	15,000.00	7,336.96	5,003.19	52.31	56.65	7.45	448.08	285.45	5.50
West Virginia	15,000.00	10,395.00	557.97	17.03	.....	34.92	1,501.77	186.36	.....
Wisconsin	15,000.00	8,180.00	2,951.62	20.00	16.56	50.50	681.31	939.54	.....
Wyoming	15,000.00	10,663.83	376.30	4.70	76.72	119.76	540.93	38.24	.....
Total	720,000.00	492,668.34	81,350.07	2,464.81	3,932.95	6,518.57	27,503.72	12,131.55	2,621.45

[1] Including balance, as follows: Delaware, $300; New York, $0.04; Virginia, $0.30.

Expenditures from United States appropriation received under the act of Mar. 16, 1906 (Adams Act), for the year ended June 30, 1915—Continued.

Station.	Classified expenditures—Continued.									
	Feeding stuffs.	Library.	Tools, implements, and machinery.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.	Buildings and repairs.	Balances.
Alabama	$375.12	$110.90	$122.60	.....	$119.90	$25.60	$149.98	.....	$72.08	.....
Arizona	38.25	3.95	125.01	.....	347.57	.....	229.17	.....	33.20	.....
Arkansas	28.00	44.45	89.72	$83.95	933.20	117.00	724.80	$7.50	212.36	.....
California	70.15	100.85	117.63	72.44	721.46	90.14	485.03	.....	166.45	.....
Colorado	.....	19.04	268.74	56.10	608.27	.....	132.80	.....	532.13	.....
Connecticut (State)	140.30	.....	7.93	.....	.....	.....	205.46	.....	.....	.....
Connecticut (Storrs)	.....	.....	.....	.....	23.67	4.25	4.60	.....	.....	.....
Delaware	.....	9.13	419.35	.....	302.68	1,500.00	546.22	.....	47.90	.....
Florida	.....	79.08	106.81	112.35	147.62	.....	491.22	.....	243.38	.....
Georgia	506.22	132.29	8.60	71.99	547.80	481.70	63.50	43.20	674.20	.....
Idaho	132.98	10.08	366.52	222.48	862.05	.....	563.44	.....	68.99	.....
Illinois	749.54	.....	120.00	3.00	4.12	65.04	97.05	.....	.....	.....
Indiana	47.57	105.86	44.04	8.50	179.36	932.46	357.39	.....	5.00	.....
Iowa	1,540.25	.....	76.03	42.54	16.40	.....	68.22	.....	.....	.....
Kansas	1,585.51	16.66	499.05	250.00	343.48	346.42	114.63	1.00	209.92	.....
Kentucky	422.10	208.81	16.18	121.20	647.27	193.95	166.18	.74	23.08	.....
Louisiana	526.75	132.14	79.63	23.90	1,191.47	191.60	374.52	.....	43.32	.....
Maine	1,769.08	80.84	58.81	34.50	200.09	.....	511.49	.....	334.48	.....
Maryland	1,404.75	225.11	526.24	304.05	698.08	.....	48.18	.....	359.47	.....
Massachusetts	.....	6.09	.....	.....	10.81	.....	8.36	.....	.....	.....
Michigan	178.09	16.94	109.69	.88	600.22	71.12	69.80	.....	.....	.....
Minnesota	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mississippi	889.53	24.00	68.38	40.49	.....	.....	257.40	.....	5.99	.....
Missouri	2,677.00	.....	278.38	3.90	341.41	450.60	190.59	.....	439.27	.....
Montana	29.13	10.12	52.10	23.05	353.02	.....	690.63	.....	.....	.....
Nebraska	.....	3.82	5.03	.....	1,054.12	.....	157.21	.....	85.73	.....
Nevada	331.36	21.30	375.25	413.05	425.27	61.00	207.58	.....	.....	.....
New Hampshire	805.73	3.60	55.24	119.64	579.95	.....	184.77	.....	396.24	.....
New Jersey	330.00	23.40	166.62	.....	3.55	.....	3.10	33.75	749.17	.....
New Mexico	658.49	24.43	1,185.62	294.83	668.68	.....	.....	.....	577.64	.....
New York (State)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New York (Cornell)	.....	41.39	126.26	2.02	76.68	.....	149.36	.....	7.75	.....
North Carolina	17.68	.....	.....	26.00	447.39	50.85	26.18	.....	.....	.....
North Dakota	1,224.39	4.00	231.91	13.70	321.06	601.60	57.30	.....	9.54	.....
Ohio	32.20	652.55	32.30	.....	2,172.33	.....	.....	.....	.....	.....
Oklahoma	988.31	11.25	107.92	32.84	2,449.46	748.46	75.21	.....	186.39	.....
Oregon	277.40	.....	181.23	42.40	421.51	.....	40.20	.....	150.00	.....
Pennsylvania	.....	.....	198.24	20.71	94.97	.....	497.99	.....	5.43	.....
Rhode Island	1,085.20	16.63	200.60	64.50	88.30	203.50	.....	.....	158.92	.....

South Carolina	941.79	44.77	118.85	2.64	308.15	.....	60.72	.....	15.85	.....
South Dakota	501.47	.....	304.80	365.97	293.77	.....	.....	.....	.....	.....
Tennessee	.....	421.40	37.90	48.77	416.61	12.25	106.80	.....	488.56	.....
Texas	98.26	23.50	121.05	8.00	1,017.75	391.47	304.72	.....	478.27	.....
Utah	198.83	82.40	196.76	17.48	245.80	18.37	255.34	.....	94.09	.....
Vermont	976.09	29.88	12.31	.....	2,174.38	.....	251.48	.....	1.30	.....
Virginia	890.83	.....	225.79	35.00	389.25	.....	247.22	.....	224.05	$0.25
Washington	4.55	.....	131.65	228.58	340.13	6.50	707.70	.....	385.30	.....
West Virginia	.....	.....	29.90	438.52	1,054.36	.....	649.67	.....	134.50	.....
Wisconsin	1,701.98	.....	212.66	.....	69.98	107.00	68.85	.....	.....	.....
Wyoming	1,306.28	144.55	86.94	314.42	452.69	118.00	18.15	.....	738.49	.....
Total	25,431.16	2,885.21	7,906.27	3,964.39	24,766.09	6,788.52	10,620.21	86.19	8,358.44	.25

Disbursements from the United States Treasury to the States and Territories for Agricultural Experiment Stations under the acts of Congress approved Mar. 2, 1887, and Mar. 16, 1906.

State or Territory.	Hatch Act.		Adams Act.	
	1888–1914	1915	1906–1914	1915
Alabama	$404,199.34	$15,000.00	$101,619.89	$15,000.00
Arizona	369,803.15	15,000.00	105,000.00	15,000.00
Arkansas	403,139.12	15,000.00	104,900.00	15,000.00
California	405,000.00	15,000.00	104,926.84	15,000.00
Colorado	404,718.82	15,000.00	103,638.93	15,000.00
Connecticut	405,000.00	15,000.00	105,000.00	15,000.00
Dakota Territory	56,250.00			
Delaware	404,382.87	15,000.00	101,750.12	14,700.00
Florida	404,966.06	15,000.00	104,996.06	15,000.00
Georgia	404,981.55	15,000.00	101,360.67	15,000.00
Idaho	329,824.13	15,000.00	100,842.22	15,000.00
Illinois	404,564.95	15,000.00	104,851.62	15,000.00
Indiana	404,901.19	15,000.00	100,000.00	15,000.00
Iowa	405,000.00	15,000.00	105,000.00	15,000.00
Kansas	404,995.00	14,995.00	105,000.00	15,000.00
Kentucky	404,996.57	15,000.00	105,000.00	15,000.00
Louisiana	405,000.00	15,000.00	105,000.00	15,000.00
Maine	404,999.62	15,000.00	105,000.00	15,000.00
Maryland	404,967.40	15,000.00	104,763.99	15,000.00
Massachusetts	404,617.70	15,000.00	105,000.00	15,000.00
Michigan	404,676.10	15,000.00	101,341.20	15,000.00
Minnesota	405,000.00	15,000.00	104,345.74	15,000.00
Mississippi	405,000.00	15,000.00	105,000.00	15,000.00
Missouri	400,097.24	15,000.00	105,000.00	15,000.00
Montana	315,000.00	15,000.00	102,417.04	15,000.00
Nebraska	404,932.16	15,000.00	105,000.00	15,000.00
Nevada	404,214.32	15,000.00	103,180.28	15,000.00
New Hampshire	405,000.00	15,000.00	105,000.00	15,000.00
New Jersey	404,949.97	15,000.00	104,558.78	15,000.00
New Mexico	369,509.05	15,000.00	105,000.00	15,000.00
New York	404,860.18	14,999.64	104,880.81	14,999.96
North Carolina	405,000.00	15,000.00	105,000.00	15,000.00
North Dakota	346,778.34	15,000.00	105,000.00	15,000.00
Ohio	405,000.00	15,000.00	103,514.02	15,000.00
Oklahoma	329,568.96	15,000.00	86,360.56	15,000.00
Oregon	390,156.64	15,000.00	100,000.00	15,000.00
Pennsylvania	404,967.43	15,000.00	104,995.41	15,000.00
Rhode Island	405,000.00	15,000.00	102,464.20	15,000.00
South Carolina	404,542.15	15,000.00	103,460.12	15,000.00
South Dakota	348,250.00	15,000.00	100,000.00	15,000.00
Tennessee	405,000.00	15,000.00	105,000.00	15,000.00
Texas	405,000.00	15,000.00	102,592.26	15,000.00
Utah	270,000.00	15,000.00	104,821.94	15,000.00
Vermont	405,000.00	15,000.00	105,000.00	15,000.00
Virginia	402,826.80	14,997.32	104,949.56	14,999.70
Washington	343,414.70	13,687.95	101,080.11	15,000.00
West Virginia	404,968.71	15,000.00	102,859.12	15,000.00
Wisconsin	405,000.00	15,000.00	105,000.00	15,000.00
Wyoming	390,000.00	15,000.00	105,000.00	15,000.00
Total	8,830,020.22	718,679.91	4,966,471.49	719,699.66

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NOTE.—The abbreviations "Ala.College," "Conn.State," "Mass.," "P.R.," etc., after entries refer to the work of the respective experiment stations, and the words "bulletin," "circular," "memoir," etc., before such abbreviations refer to publications of the respective experiment stations mentioned by title in the text.

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PART II.

A REPORT ON THE RECEIPTS, EXPENDITURES, AND RESULTS OF COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS IN THE UNITED STATES, 1915.

STATES RELATIONS SERVICE.

A. C. TRUE, Director.

OFFICE OF EXTENSION WORK IN THE SOUTH.

BRADFORD KNAPP, Chief.

States.

Texas, Oklahoma, Louisiana, Arkansas, Tennessee, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Virginia, Maryland, West Virginia, and Kentucky.

Washington Staff.

COOPERATIVE RELATIONS AND COUNTY-AGENT WORK.

J. A. EVANS, Assistant chief.
W. D. BENTLEY, Agriculturist and field agent in general charge of projects, etc., and acting in charge of work for Oklahoma and Texas.
W. B. MERCIER, Agriculturist and field agent for Arkansas, Louisiana, Tennessee, and North Carolina.
H. E. SAVELY, Agriculturist and field agent for Mississippi, Alabama, South Carolina, Georgia, and Florida.
———, Agriculturist and field agent for Kentucky, Maryland, Virginia, and West Virginia.
J. D. MCVEAN, Specialist in animal husbandry.
J. H. MCCLAIN, Specialist in dairy husbandry.
———, Specialist in poultry husbandry.
W. R. MATTOON, Specialist in forestry.
C. L. GOODRICH, Specialist in farm management.
L. O. WATSON, Specialist in cotton and truck crop diseases.

BOYS' AND GIRLS' CLUB WORK AND HOME-DEMONSTRATION WORK.

O. B. MARTIN, Assistant in charge of boys' and girls' club work and home-demonstration work.
I. W. HILL, Assistant in boys' club work.
MARY E. CRESWELL, Assistant in home demonstration and girls' club work.
OLA POWELL, Assistant in home demonstration and girls' club work.

ASSISTANTS.

H. W. BARBER, Assistant in charge of crop records and statistics.
W. H. CONWAY, Executive assistant.

Cooperative Field Extension Staff.

COUNTY AGENT AND BOYS' CLUB WORK.

Men Agents: 15 directors, 15 State agents, 23 assistant State agents, 43 district agents, 731 county agents, 51 local agents for negroes, 26 special community leaders in club work.

Women Agents: 14 State agents, 14 assistant State agents, 8 district agents, 410 county agents, 5 local agents for negroes.

OFFICE OF EXTENSION WORK IN THE NORTH AND WEST.

C. B. SMITH, Chief.

States.

Arizona, California, Colorado, Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, Wisconsin, Wyoming.

Washington Staff.

COOPERATIVE RELATIONS.

L. A. CLINTON, Assistant chief.
D. W. WORKING, Agriculturist.
R. W. REDMAN, Agriculturist.
A. B. GRAHAM, Assistant agriculturist.

COUNTY-AGENT WORK.

W. A. LLOYD, Agriculturist, in charge.
H. B. FULLER, Agriculturist.
H. J. WILDER, Agriculturist.
L. R. SIMONS, Agriculturist.
W. M. COOK, Agriculturist.
O. S. FISHER, Agriculturist.
H. W. GILBERTSON, Assistant agriculturist.

BOYS' AND GIRLS' CLUB WORK.

O. H. BENSON, Agriculturist, in charge.
GEORGE E. FARRELL, Assistant agriculturist.

FARM-MANAGEMENT DEMONSTRATIONS.

L. H. GODDARD, Agriculturist, in charge.
E. A. BROWN, Agriculturist.
W. D. HILL, Scientific assistant.
P. K. WHELPTON, Scientific assistant.

EXTENSION WORK WITH FARM WOMEN.

FLORENCE E. WARD, Assistant agriculturist, in charge.

EXECUTIVE ASSISTANT.

J. A. LIGGETT.

Cooperative Field Extension Staff.

COUNTY-AGENT WORK.

30 State county-agent leaders, 15 assistant State county-agent leaders, 429 county agents.

BOYS' AND GIRLS' CLUB WORK.

25 State leaders, 18 assistant State leaders, 9 district club leaders.

FARM-MANAGEMENT DEMONSTRATIONS.

22 State demonstrators, 6 assistant State demonstrators.

HOME-DEMONSTRATION WORK.

6 State leaders, 14 county home-demonstration agents.

ADDRESS LIST OF STATE INSTITUTIONS AND OFFICERS IN CHARGE OF AGRICULTURAL EXTENSION WORK.

State.	Officer in charge of extension work.	Address.
Alabama	J. F. Duggar	Alabama Polytechnic Institute, Auburn.
Arizona	E. P. Taylor	College of Agriculture, University of Arizona, Tucson.
Arkansas	J. H. Miller	College of Agriculture, University of Arkansas, Fayetteville.
California	W. T. Clarke	College of Agriculture, University of California, Berkeley.
Colorado	H. T. French	State Agricultural College of Colorado, Fort Collins.
Connecticut	H. J. Baker	Connecticut Agricultural College, Storrs.
Delaware	H. Hayward	Delaware College, Newark.
Florida	P. H. Rolfs	College of Agriculture, University of Florida, Gainesville.
Georgia.	J. Phil Campbell	Georgia State College of Agriculture, Athens.
Idaho	O. D. Center	The State House, Boise.
Illinois	W. F. Handschin	College of Agriculture, University of Illinois, Urbana.
Indiana	G. I. Christie	Purdue University, La Fayette.
Iowa	R. K. Bliss	Iowa State College, Ames.
Kansas	E. C. Johnson	Kansas State Agricultural College, Manhattan.
Kentucky	Fred Mutchler	College of Agriculture, The State University, Lexington.
Louisiana	W. R. Dodson	Louisiana State University and Agricultural and Mechanical College, Baton Rouge.
Maine	L. S. Merrill	College of Agriculture, University of Maine, Orono.
Maryland	T. B. Symons	Maryland State College of Agriculture, College Park.
Massachusetts	W. D. Hurd	Massachusetts Agricultural College, Amherst.
Michigan	R. J. Baldwin	Michigan Agricultural College, East Lansing.
Minnesota	A. D. Wilson	College of Agriculture, University of Minnesota, University Farm, St. Paul.
Mississippi	E. R. Lloyd	Mississippi Agricultural and Mechanical College, Agricultural College.
Missouri	A. J. Meyer	College of Agriculture, University of Missouri, Columbia.
Montana	F. S. Cooley	Montana State College, Bozeman.
Nebraska	C. W. Pugsley	College of Agriculture, University of Nebraska, Lincoln.
Nevada	C. A. Norcross	College of Agriculture, University of Nevada, Reno.
New Hampshire.	J. C. Kendall	New Hampshire College of Agriculture and the Mechanic Arts, Durham.
New Jersey	Alva Agee	Rutgers College, New Brunswick.
New Mexico	A. C. Cooley	New Mexico College of Agriculture and Mechanic Arts, State College.
New York	A. R. Mann[1]	New York State College of Agriculture, Ithaca.
North Carolina	B. W. Kilgore	North Carolina College of Agriculture and Mechanic Arts, West Raleigh.
North Dakota	T. P. Cooper	North Dakota Agricultural College, Agricultural College.
Ohio	C. S. Wheeler	College of Agriculture, Ohio State University, Columbus.
Oklahoma	J. A. Wilson	Oklahoma Agricultural and Mechanical College, Stillwater.
Oregon	R. D. Hetzel	Oregon State Agricultural College, Corvallis.
Pennsylvania	M. S. McDowell	Pennsylvania State College, State College.
Rhode Island	Howard Edwards[1]	Rhode Island State College, Kingston.
South Carolina	W. W. Long	Clemson Agricultural College of South Carolina, Clemson College.
South Dakota	G. W. Randlett	South Dakota State College, Brookings.
Tennessee	C. A. Keffer	College of Agriculture, University of Tennessee, Knoxville.
Texas	Clarence Ousley	Agricultural and Mechanical College of Texas, College Station.
Utah	J. T. Caine, III	Agricultural College of Utah, Logan.
Vermont	Thomas Bradlee	University of Vermont and State Agricultural College, Burlington.
Virginia	J. M. Jones	Virginia Polytechnic Institute, Blacksburg.
Washington	W. S. Thornber	State College of Washington, Pullman.
West Virginia	C. R. Titlow	College of Agriculture, West Virginia University, Morgantown.
Wisconsin	K. L. Hatch	College of Agriculture, University of Wisconsin, Madison.
Wyoming	A. E. Bowman	College of Agriculture, University of Wyoming, Laramie.

[1] Acting director.

OFFICIALS IN CHARGE OF FARMERS' INSTITUTE WORK IN THE STATES

[Corrected to Apr. 1, 1916.]

ALABAMA.—C. A. Cary, Alabama Polytechnic Institute, Auburn.
DELAWARE.—Wesley Webb, secretary State board of agriculture, Dover.
ILLINOIS.—Mrs. H. A. McKeene, secretary pro tem, Illinois farmers' institutes, Springfield.
IOWA.—A. R. Corey, secretary State board of agriculture, Des Moines.
KENTUCKY.—Harry McCarty, director of institutes, Frankfort.
LOUISIANA.—H. D. Wilson, commissioner of agriculture, Baton Rouge.
MAINE.—W. G. Guptill, commissioner of agriculture, Augusta.
MARYLAND.—R. S. Hill, director of farmers' institutes, Upper Marlboro.
MASSACHUSETTS.—Wilfrid Wheeler, secretary State board of agriculture, Boston.
MICHIGAN.—L. R. Taft, superintendent of farmers' institutes, East Lansing.
MISSOURI.—Jewell Mayes, secretary State board of agriculture, Columbia.
NEW HAMPSHIRE.—Andrew L. Felker, commissioner of agriculture, Concord.
NEW JERSEY.—Alexis L. Clark, director of farmers' institutes, Trenton.
NEW YORK.—Edward Van Alstyne, director bureau of farmers' institutes, Albany.
NORTH CAROLINA.—T. B. Parker, director of farmers' institutes, Raleigh.
PENNSYLVANIA.—C. E. Carothers, director of farmers' institutes, Harrisburg.
RHODE ISLAND.—John J. Dunn, secretary State board of agriculture, Providence.
TEXAS.—J. W. Neill, director of institutes, Austin.
VERMONT.—Elbert S. Brigham, commissioner of agriculture, St. Albans.
VIRGINIA.—J. J. Owen, director of institutes, Richmond.

OFFICIALS IN CHARGE OF FARMERS' INSTITUTE WORK IN THE AGRICULTURAL COLLEGES.

[Corrected to Apr. 1, 1916.]

ARIZONA.—E. P. Taylor, director of extension, college of agriculture, Tucson.
ARKANSAS.—J. H. Miller, director of extension, college of agriculture, Fayetteville.
CALIFORNIA.—W. T. Clarke, director of extension, college of agriculture, Berkeley.
COLORADO.—H. T. French, director of extension, college of agriculture, Fort Collins.
CONNECTICUT.—H. J. Baker, director of extension, agricultural college, Storrs.
FLORIDA.—P. H. Rolfs, director of extension, college of agriculture, Gainesville.
GEORGIA.—J. Phil Campbell, director of extension, college of agriculture, Athens.
IDAHO.—O. D. Center, director of extension, State House, Boise.
INDIANA.—W. C. Latta, farmers' institute specialist, Purdue University, La Fayette.
KANSAS.—Edward C. Johnson, director of extension, college of agriculture, Manhattan.
MINNESOTA.—A. D. Wilson, director of extension, University Farm, St. Paul.
MISSISSIPPI.—R. H. Pate, superintendent of farmers' institutes, Agricultural College.
MONTANA.—F. S. Cooley, director of extension, agricultural college, Bozeman.
NEBRASKA.—C. W. Pugsley, director of extension, college of agriculture, Lincoln.
NEVADA.—C. A. Norcross, director of extension, college of agriculture, Reno.
NEW MEXICO.—A. C. Cooley, director of extension, State College.
NORTH DAKOTA.—Frank Sanford, superintendent of farmers' institutes, Agricultural College.
OHIO.—F. L. Allen, supervisor of institutes and schools, State University, Columbus.
OKLAHOMA.—J. A. Wilson, director of extension, college of agriculture, Stillwater.
OREGON.—R. D. Hetzel, director of extension department, college of agriculture, Corvallis.
SOUTH CAROLINA.—W. W. Long, director of extension, Clemson College.
SOUTH DAKOTA.—H. H. Stoner, superintendent of short courses, State College of Agriculture (P. O. Highmore).
TENNESSEE.—C. A. Keffer, director of extension, college of agriculture, Knoxville.
UTAH.—J. T. Caine, III, director of extension, college of agriculture, Logan.
WASHINGTON.—W. S. Thornber, director of extension, college of agriculture, Pullman.
WEST VIRGINIA.—C. R. Titlow, director of extension, college of agriculture, Morgantown.
WISCONSIN.—E. L. Luther, superintendent of farmers' institutes, College of Agriculture, Madison.
WYOMING.—H. G. Knight, director of agricultural experiment station, Laramie.

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EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS IN THE UNITED STATES, 1915.

INTRODUCTION.

On May 8, 1914, the President approved an act to provide for cooperative agricultural extension work (Smith-Lever Act) between the agricultural colleges in the several States receiving the benefits of an act of Congress approved July 2, 1862, and of acts supplementary thereto, and the United States Department of Agriculture.

Section 7 of this act requires that the Secretary of Agriculture make an annual report to Congress of the receipts, expenditures, and results of cooperative agricultural extension work in all of the States receiving the benefits of the act. This is the first report fulfilling this requirement.

The cooperative agricultural-extension work as defined in the extension act consists "of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications, and otherwise."

The act appropriates $10,000 annually to each State, beginning with 1914–15; and $600,000 additional for 1915–16 to be divided in the proportion that the rural population of each State bears to the total rural population of the United States, and for each year thereafter for seven succeeding years a sum exceeding by $500,000 the sum appropriated for each preceding year. These additional amounts are appropriated with the proviso that a like amount shall be contributed for similar work from within the States.

The Secretary of Agriculture is charged with the administration of the act. To provide an organization within the Department of Agriculture for conducting its business in relation to the cooperative extension work a States Relations Committee was first created and had charge of this work for the year covered by this report, pending the authorization by Congress of the reorganization of the Department of Agriculture and the establishment of the States Relations Service. This committee consisted of the Director and Assistant

Director of the then Office of Experiment Stations, the special agent in Charge of Farmers' Cooperative Demonstration Work in the South, and the special agent in Charge of Farmers' Cooperative Demonstration work in the Northern and Western States. On July 1, 1915, the States Relations Service came into existence and took over the management of the department's business relating to extension work.

In order to prevent duplication in extension activities and to coordinate properly the extension work of the State colleges of agriculture and the United States Department of Agriculture written agreements were made between the department and the colleges, and these were usually based on a general "memorandum of understanding." This memorandum provides (1) that the States shall organize and maintain definite and distinct administrative divisions of the college for extension work; (2) that all funds for extension work in agriculture and home economics shall be expended through such extension divisions; and (3) that the United States Department of Agriculture shall cooperate with the extension divisions of the colleges in such work done by the department in the States. The Department of Agriculture in this memorandum also agrees to administer all its extension activities through the States Relations Committee, and later the States Relations Service.

Section 2 of the act requires that the cooperative extension work shall be carried on in such manner as may be mutually agreed upon by the Secretary of Agriculture and the State agricultural colleges. To fulfill this requirement the latter submitted written projects outlining their organization and plan of work for 1914–15, which were approved by the committee and the Secretary of Agriculture.

Of the $480,000 appropriated under the provisions of the Smith-Lever Act, $128,083.33 was used for carrying on demonstrations by means of county agents, $69,890.05 for demonstration work in home ecomonics, $32,944.29 for demonstrations by means of boys' clubs, and $33,821.65 for demonstrations by means of movable schools. There was also spent $86,278.39 for paying the salaries and expenses of the administrative officials, and $8,241.16 for the printing and distribution of extension publications. The remainder of the Smith-Lever fund was spent for the salaries and expenses of a large number of extension specialists, the principal types consisting of specialists in dairying, horticulture, agronomy, farm management, and animal husbandry.

The total amount of money expended for the cooperative agricultural-extension work approximated $3,600,000, derived from the following sources: Smith-Lever, $475,000; State funds appropriated specifically for extension work, $725,000; appropriations by county authorities, $780,000; funds under the direct control of the college,

$320,000; appropriations to the Department of Agriculture for farmers' cooperative demonstration work, over $900,000; appropriations to other bureaus and offices of the department, over $100,000; and $290,000 from various other sources, such as farmers' organizations, chambers of commerce, individuals, etc.

Of this total amount from all sources, over one-half was used for demonstrations by means of county agents. The next item in importance was the demonstrations in home economics with a total of over $320,000. Among the other important items were $200,000 for movable schools, $165,000 for boys' clubs, $300,000 for administration, $106,000 for dairying, and $72,000 for the printing and distribution of publications. The remainder was spent for other types of specialists to aid and strengthen the work of the county agents.

The total number of agricultural counties in the United States is estimated at 2,920. At the beginning of the year 929 of these counties had the services of a county agent, while at the end of the year 1,136 had such services.

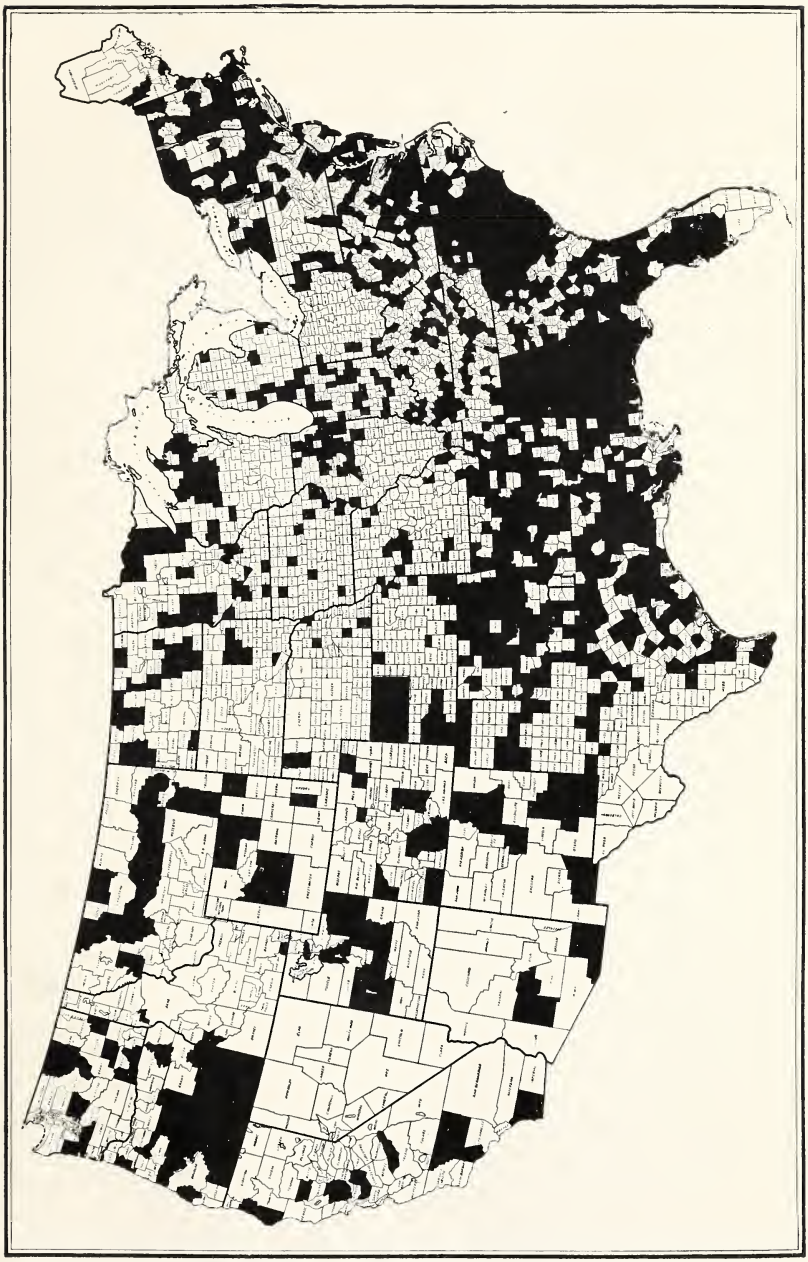
Extension work of various kinds had been carried on by the colleges and the department long before the passage of the Smith-Lever Act, which in reality represented the culmination of a great movement for the popular diffusion of agricultural knowledge. It has therefore seemed best in this first report on the operations of the Smith-Lever Act to call attention to the historical development of different phases of agricultural-extension work in the United States. For this purpose under each State and section is given a brief historical statement regarding the development of its agricultural-extension work, the organization of the extension division, and the results obtained for each project.

The extension business of the States Relations Service is carried on through two extension offices, one having charge of the work in 15 Southern States and the other in the 33 Northern and Western States. The development of the department's extension work in the South preceded that in the North and West by several years, and somewhat different types of work and organizations have been followed in the two regions. It has therefore been most convenient and appropriate to summarize the work in each region separately in this report.

The Smith-Lever Act provides for financial reports to be furnished by the State colleges on or before September 1 in each year and detailed reports of operations, receipts, and expenditures on or before January 1. This report is based upon reports of the directors and leaders of the different lines of work, the financial reports showing receipts and expenditures, the reports submitted by the inspectors of the department, who visited each of the colleges of agriculture to

examine the accounts and ascertain the results obtained from the expenditure of the extension funds, and any available publications relating to extension work.

In many States that form of extension work which is known as farmers' institutes has had a quite distinct organization. In 24 States during the year covered by this report the institutes were under the control of the agricultural colleges and in 24 States were managed by the State departments of agriculture. For a number of years this department has maintained an office, now in the States Relations Service, to promote the general interests of the farmers' institutes and report on their work. In order to give a comprehensive view of agricultural-extension activities in the United States a supplementary chapter on the farmers' institutes activities in 1914–15 is included in this report.



COUNTIES HAVING MEN AGENTS, 1915.

COUNTIES HAVING WOMEN AGENTS, 1915.

EXTENSION WORK IN THE SOUTH.

HISTORICAL.

Almost from the beginning of our national history more or less attention has been given to the improvement of agriculture. From the early days some attempt was made to organize the communities for the discussion of problems relating to the farm. There seems to have been difficulty, however, in effecting anything permanent or far-reaching.

Probably the first real agricultural society in the United States was organized in Philadelphia in 1785. Its membership included prominent people from several neighboring States, among whom were George Washington and Benjamin Franklin. The same year an agricultural society was organized at Charleston, S. C., by the leading farmers in and around that city. This society has maintained its organization and still holds occasional meetings for the discussion of agricultural questions. The Pendleton Farmers' Society of South Carolina was organized in 1815 by prominent farmers of that section of the State. This society is still in existence and has had many prominent citizens among its membership. Similar organizations were started in other Southern States, but few of them have unbroken records. Kentucky appears to have had a society organized in 1817, Maryland in 1818, and Louisiana in 1833. These early societies were more or less for the social side of farm life, as well as for educational and instructive purposes.

The period between 1850 and 1870 was noted for the organization of fair associations and the holding of local and State fairs or agricultural shows for the purpose of promoting agriculture, horticulture, and live-stock raising. Since 1840 meetings have been held in some of the States for disseminating agricultural information to the rural people. Few, if any, of these early organizations received State or National aid, the success and continuance of their operation depending on a few public-spirited and progressive men.

No doubt these early societies and clubs formed the nucleus about which a few of the forward thinking men, with a vision of the agricultural possibilities of our country and its needs for development, formulated plans for the system of agricultural and industrial in-

stitutions that have now become such popular and powerful factors for good in each State. There was agitation for the establishment of a chair of agriculture in some of the State schools before the passage by Congress of what is known as the Morrill Act. The passage of this act was the first National aid to State schools. When the law became operative nearly every State university created a chair of agriculture. It was probably several years later before any real effort was made to establish agricultural and mechanical colleges, either as a part of the university or as a separate institution. In 1887 Congress passed the Hatch Act, by which, under certain conditions, each State received Federal support for conducting experiment stations in connection with the agricultural colleges. In their early days the experiment stations did some very effective and far-reaching investigational work, and this may be considered the beginning of the great awakening in agriculture throughout the South.

INSTITUTE WORK.

The agricultural-college and the experiment-station forces attempted to give some instruction in agriculture by lectures delivered away from the institution. This was really the beginning of farmers' institute work. No regularly organized farmers' institutes were conducted in the South until about 1890, when some of the colleges organized a force in the institution for this purpose. In a few States the institute work was done through the State departments of agriculture, but in such cases members of the college and station force were often the principal speakers.

Farmers' institutes accomplished much in arousing interest in better methods on the farm, and doubtless did much to promote the idea of extension work as it is now being developed. Some of the difficulties found in reaching a great majority of country people by this method were in the limited financial support, the small available working force, and the too frequent holding of meetings in small towns instead of in the farm communities or on the farm. Also, meetings were usually held but once a year with no follow-up work for keeping the farmer interested and instructed. Meetings were frequently poorly attended, and most of the farmers who came were progressive and already appreciated the value of such sources of information. The great mass of average farmers who were not progressive, who did not read, and who needed instruction in better methods did not attend these meetings. Just how to reach these and help them to improve farm conditions and increase the family income was a question that had puzzled many of our agricultural leaders.

The experiment stations, agricultural colleges, and the Federal Department of Agriculture were all accumulating great stores of useful information for the benefit of the farmers. There was no thoroughly effective system for getting this accumulated knowledge into practice among farmers generally. The institutes and other meetings and the publication of bulletins largely failed to accomplish the objects because relatively few of the people put the new methods into practice. As a rule, also, all of the forces were mainly confining their efforts in the field to more or less formal teaching and there was comparatively little study of the problem of reaching the farmer in such a way as to induce him to adopt better farm practices. The farmer is not a specialist; he is interested in farm management and in the business side of farming more than he is in the technical detail of each particular crop or the production of each species of farm animal. There was a need of practical men who could translate things into terms which the farmer could understand, and an organized system through which the accumulated knowledge of the various institutions could be translated into actual practice.

DEVELOPMENT OF COUNTY DEMONSTRATION AGENTS' WORK.

It had long been recognized that there was a missing link in our system for instructing the rural people. While great strides had been made in working out and assembling agricultural information, no adequate system for getting it to the masses of people in a workable form had been found.

Some European countries attempt to instruct the rural population through teachers who go from farm to farm and village to village. A similar plan had been tried locally in a few places in this country, but no systematic and comprehensive plan for the education of the farming people in the districts remote from schools and colleges had been attempted before the farmers' cooperative demonstration work was organized by the United States Department of Agriculture. The opportunity, if not the cause, for establishing the system of disseminating information through demonstration agents was the spread of the Mexican cotton-boll weevil in Texas. Cotton had been the chief crop of this section, and on its production rested the credit and prosperity of the people. The impression had gone out that cotton could not be grown successfully after the weevil came. How to overcome this common belief was the all-important question, not only for the State but for the national authorities. There were different ideas of plans for meeting the crisis, but all agreed that the entire economic and cropping system must be radically changed. The difficulties in changing a long-established custom of a naturally

conservative people were fully recognized. Dr. S. A. Knapp, who was in charge of this line of the department's work, had been for many years prominently connected with the experiment stations and agricultural colleges of the States. His chief ambition had been to develop a practical scheme of rural education which would enable the great body of average farmers to increase their earning capacity and teach them to help themselves without having them sacrifice their self-respect or initiative. Dr. Knapp had for a long time believed that the demonstration idea was the best method of accomplishing his aim. His plan was to get object lessons in every community, and by personal contact with the farmer induce him with his own hands on his own farm to put into practice improved methods. The results from this local, permanent object lesson would be a powerful influence for good in the community.

In 1903–4 Congress made an appropriation for boll-weevil work, a portion of which was given to carry out the demonstration idea. Dr. Knapp, with a few assistants and the cooperation of business men, established demonstration farms near the business centers in a number of counties in eastern Texas and Louisiana, enlisting, also, several thousand farmers, who agreed to test the department's instructions on their farms. The first two years the work was confined entirely to cotton. The results were most satisfactory. The cotton production was increased and confidence largely restored. The simplicity and directness of the plan and its phenomenal success began to attract the attention of leading thinkers and educators the country over. In 1906 the weevil continued to spread, and the work was extended into Arkansas and Oklahoma and increased in Louisiana and Texas. The appropriations made by Congress for extending the work were still very limited and its use confined entirely to boll-weevil territory.

The General Education Board of New York, being impressed with the possibilities offered by the extension of the demonstration plan outside of boll-weevil territory, offered funds for this purpose, to be administered through the department under Dr. Knapp's supervision. In 1906 this offer was accepted by the Secretary and the work was begun in Mississippi, Alabama, and Virginia. The General Education Board increased appropriations from year to year for the extension of the work in the nonboll-weevil States, agents in this territory being paid entirely from its funds, except the nominal salary of $1 per annum by the Government to make them actual employees of the department. Up to July 1, 1914, the General Education Board had put into the demonstration work in the nonboll-weevil States $863,250, which was administered entirely through the Department of Agriculture. At the same time the direct appropriations from Congress grew rapidly as the effectiveness of the work was appreciated.

TABLE I.—*Expenditures from all sources, farmers' cooperative demonstration work, 1904 to 1915, inclusive.*

Fiscal year.	United States Department of Agriculture lump funds.	General Education Board.	Other funds.	Smith-Lever.	Total.
1904	$27,316.04	.....	.....	.....	$27,316.04
1905	40,163.29	.....	.....	.....	40,163.29
1906	37,677.80	$7,000.00	.....	.....	44,677.80
1907	39,976.73	31,200.00	$2,800.00	.....	73,976.73
1908	85,901.48	69,000.00	4,200.00	.....	159,101.48
1909	102,898.30	76,500.00	14,297.00	.....	193,695.30
1910	219,107.37	102,000.00	33,714.41	.....	354,821.78
1911	243,246.61	120,000.00	76,622.06	.....	439,868.67
1912	335,856.29	128,000.00	175,054.13	.....	638,910.42
1913	330,014.92	142,050.00	272,568.57	.....	744,633.49
1914	371,800.28	[1] 187,500.00	411,179.21	.....	970,479.49
1915	661,217.79	.....	730,643.48	$147,788.54	1,539,649.81
Total	2,495,176.90	863,250.00	1,721,078.86	147,788.54	5,227,294.30

[1] Actual expenditure from Oct. 1, 1913, to June 30, 1914.

Effective July 1, 1914, Congress appropriated funds sufficient to take over the entire work. This liberal support made it possible to promote, expand, and establish this effective method of rural education much more rapidly than would have been possible otherwise.

At first the agent covered considerable territory, sometimes as much as 10 or 15 counties. Demonstration farms were established along the railroads where they could be easily reached. It was soon realized that more intensive work would be a great deal more effective. In 1907 the first agent was appointed to work exclusively in one county. Part of his salary was paid by the business men of the county. Very few men or women agents now have more than one county. Some counties have two men and a woman agent. Practically all county agents' salaries in the South are now paid partly from extension and department funds and partly from county taxes.

In 1909 the State of Mississippi took the lead in recognizing the work and its influence upon the State by enacting a law under which the county might pay part of the salary of the county agent. In the years 1909 to 1915, inclusive, every Southern State having power under its constitution to grant such authority to the county passed laws permitting the county government to cooperate with the United States Department of Agriculture in financing the farmers' cooperative demonstration work in the county by paying a part of the salary of the county agent. Under these laws the contribution from the county comes from the general taxes of the county, and the burden, therefore, is apportioned among the people. Some States have made direct appropriations in addition to those made by counties, notably in Alabama, where an annual appropriation of $25,000 began in 1911.

Under this system the work was extended to all of the Southern States. With the yearly increasing funds from Congress, the General Education Board of New York, and the State, county, and local sources, the organization was enabled to grow very rapidly. Table II shows the annual growth in number of agents by States.

TABLE II.—*Number of agents engaged in farmers' cooperative demonstration work since its beginning in 1904 to 1915, inclusive, in cooperation with colleges, counties, and local organizations.*

State.	1901[1]	1905[1]	1906[1]	1907	1908	1909	1910	1911[2]	1912[2]	1913[2]	1914[2]	1915[2]
Texas	.....	.....	.....	20	28	55	65	71	134	116	133	128
Oklahoma	.....	.....	.....	.....	8	16	30	34	54	54	67	83
Louisiana	.....	.....	.....	9	13	44	46	49	60	54	68	58
Arkansas	.....	.....	.....	6	12	28	50	54	68	71	80	83
Mississippi	.....	.....	.....	7	23	37	40	54	78	68	80	84
Alabama	.....	.....	.....	5	17	32	43	83	95	91	101	95
Georgia	.....	.....	.....	.....	7	28	53	57	86	99	112	118
Florida	.....	.....	.....	.....	.....	2	14	14	40	40	61	66
South Carolina	.....	.....	.....	.....	15	27	43	56	69	68	84	84
North Carolina	.....	.....	.....	.....	13	24	51	51	73	91	108	116
Virginia	.....	.....	.....	2	17	24	28	50	65	79	92	99
Maryland	.....	.....	.....	.....	.....	.....	.....	.....	6	7	18	23
Tennessee	.....	.....	.....	.....	.....	.....	1	10	23	40	49	67
Kentucky	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43	69
West Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	42	56
Total	15	20	25	49	153	317	464	583	851	878	1,138	1,229

[1] Estimate. No records available to show the actual number in each State.
[2] Includes women agents.

The scope of the work was extended to cover almost every phase of agriculture. Special effort was made to promote soil improvement, crop diversification, and raising of live stock throughout the cotton region.

Leaders of the demonstration work soon realized that to make it a permanent success the boys and girls must be included in the general organization. In 1907–8 boys' corn clubs were organized in a few counties in Mississippi and Texas, and in 1909 regularly organized club work was started in several States. (See report under project for boys' clubs, p. —.)

In 1911 girls' canning-club work was organized on a small scale in two States—South Carolina and Virginia. This preliminary work attracted so much attention that the General Education Board offered to finance the work entirely for the first few years. (See report under project for canning-club and home-demonstration work, p. 32.)

COOPERATION.

The farmers' cooperative demonstration work of the department remained an independent organization in the States until about 1909, when by agreement with some of the agricultural colleges a joint agent was appointed to have charge of the boys' club work.

In December, 1911, Clemson Agricultural College of South Carolina and the United States Department of Agriculture arranged a cooperative agreement, which was formally signed in January, 1912, for carrying on all extension work in the State. So far as known this was the first college in the country to enter into a cooperative arrangement with the United States Department of Agriculture to carry on all its extension work. Similar agreements were entered into in 1912 by Georgia and Texas, and in 1913 by Florida, West Virginia, and North Carolina.

After the passage of the Smith-Lever Act, May 8, 1914, the extension work of the department and of the colleges was, by virtue of the act itself, made cooperative. The assent of the governors of the various States was secured, and a general memorandum of understanding was signed between the colleges and the department in all of the 15 Southern States except 1 for conducting the work during the fiscal year of 1914–15. A division of extension was established in each of the institutions as an independent division of the college of agriculture, ranking with the experiment stations or college teaching force. As soon as the division of extension was established in the several State institutions the outline of work was set forth in definite projects, which were agreed to in a conference between the representatives of the college and of the Department of Agriculture. Each project is approved and signed by duly authorized representatives of the department and the colleges.

ORGANIZATION AND ADMINISTRATION.

There is a director in charge of the extension work in each of the 15 Southern States, who is the responsible head of the work in the State. By the terms of the project agreements in each State the director is responsible to the agricultural college and also to the department for the faithful carrying out of the project agreements in the State. In Alabama, Florida, Louisiana, Mississippi, and North Carolina the director of extension is also director of the experiment station. Each of the 15 Southern States except two has a State agent who has supervision of all of the field work of the county agents, with an assistant in charge of the boys' clubs and another in charge of the girls' clubs and home-demonstration work. In Alabama and Louisiana the State agent has charge of the men's work only. The boys' club work and the girls' and women's work are under the supervision of a superintendent of junior extension who is responsible to the director. In Arkansas, Kentucky, Maryland, Oklahoma, South Carolina, Tennessee, Texas, and West Virginia the director devotes his entire time to extension work. In all but Oklahoma, South Carolina, and Tennessee, he is assisted by

a State agent who has an assistant in the boys' club work and an assistant in the girls' club and home-demonstration work. In Tennessee the assistant director performs the duties usually assigned to the State agent and also becomes acting director in the absence of the director, and there is also an assistant director in charge of the girls' canning-club and home-demonstration work. In South Carolina and Oklahoma the work is in charge of a director who is also State agent. Each has an assistant in charge of the boys' club work and an assistant in charge of the girls' club and home-demonstration work. In Virginia the president of the college is acting director of extension, and under him is the State agent in charge of the men's county-agent work and the boys' work, and a woman State agent in charge of the girls' club and home-demonstration work. In addition to the director, assistant director, and State agent each State has district agents who have charge of a certain number of county agents.

There is also connected with the extension division in each State a corps of specialists, working under definite projects, whose duties are to gather and furnish reliable information in their particular lines to the county agents and farmers throughout the State. The specialists in their field operations in counties with agents are to work through the agent and must plan demonstrations in the county with his knowledge and cooperation and under his charge as a part of his work. The subject matter used by the extension division in field instruction must be submitted to the heads of the different divisions of the college and experiment station for approval. Manuscripts for circulars, bulletins, or other publications prepared for use in extension work must also be submitted for approval as to subject matter. Cordial relations exist in all the States between the extension division and other departments of the college. As already stated, the director of the station is also, in some cases, director of extension. In a few instances the members of the station staff are devoting part of their time to extension work. The members of the experiment station and the college teaching force are used freely in the movable schools and institute work carried on under the direction of the division of extension.

In Alabama, Florida, Kentucky, North Carolina, and Oklahoma the State departments of agriculture are cooperating with the extension division and the United States Department of Agriculture in carrying on the extension work. In the other States the division of extension has the friendly cooperation of the State departments but no direct official connection with them. In Tennessee, Oklahoma, Mississippi, and Louisiana there is official cooperation with the State departments of education. In Tennessee, in addition to the cooperation with the State department of education, many of the county

agents are employed cooperatively with the county boards of education, and the same is true in some parishes of Louisiana.

There are a number of projects which are not financed directly from the Smith-Lever funds but are included in the activities of the regular division. Notable among these is the live-stock work in Louisiana, which is being conducted under a special appropriation from the National Congress for the benefit of the sugar and cotton planters. There is also cooperative work being carried on with other branches of the department, such as the Bureau of Animal Industry and the Office of Markets.

The extension division in each State is conducting what is known as movable schools or short courses, and other meetings which, in large measure, have taken the place of institute work. Much attention has been given to farmers' clubs and organizations in the last year or more. Where it is possible, the extension division is promoting and cooperating in this kind of work with the local organizations already in existence.

The division of extension in a number of the States has an editor in charge of the publication and distribution of literature. These publications consist of circulars, bulletins, plate material, circular letters, leaflets, etc., and are prepared by members of the extension division, experiment station, or college force, and are written at such times and on such subjects as conditions may require. All these publications are designed for the use of the county agents in the field and are written in a style that is easily understood by the ordinary farmer. The material for these extension publications is gathered by writers from practical results in the field work, from information worked out by the experiment station, and from data secured by the United States Department of Agriculture. A mailing list is maintained at the headquarters of the extension division in each State. This is not yet complete, but is being arranged and added to. The principal lists at present are those furnished by the county agents, the experiment-station list, and a list of farmers and interested people throughout the State.

In all cases the land-grant colleges were designated to receive the benefits of the Smith-Lever funds, and under the terms of the law creating the cooperative extension work each institution was to furnish suitable buildings as headquarters for the administrative officers of the division, equipment, and clerical assistance. This provision has been complied with in all the States. The director, State agent, and their assistants, and, in some cases, the district agents, and all of the specialists have their headquarters at the same place. In most cases an entire building or a definite portion of some building is turned over for exclusive use of the extension division. The

extension workers in some States are fairly well equipped with illustrative material, lantern slides, moving pictures, charts, etc., for use in lecture and short-course work. Practically all members of the extension division in each State are considered joint representatives of the department and the college, and in some instances supervising members of the extension division are listed with the college faculty. In all cases the director himself has full voice as a member of the executive branch of the faculty.

FINANCES.

All funds going into the extension work in every State are spent in accordance with the acts of Congress making the appropriation and of the State legislatures where State funds are involved. The following shows the amounts and sources of all money used for carrying on the extension work in the South for the fiscal year of 1914–15:

Federal Smith-Lever	$147,538.54
State appropriation	171,456.90
College	96,982.21
Counties and local	462,204.37
United States Department of Agriculture, State Relations Service, farmers' cooperative demonstration work	[1] 599,596.63
United States Department of Agriculture, other bureaus	68,532.45
Total	1,546,311.10

The Smith-Lever funds were expended in carrying out the following projects in the 15 Southern States: Administration, publications, county agents, boys' clubs, girls' clubs, home economics, poultry, dairying, agronomy, animal husbandry, horticulture, rural organizations, rural engineering and sanitation, marketing, hog cholera, fruit diseases, movable schools, traveling equipment, and supplies. No one State had all these projects. Every State had a project for administration, publications, county agents, boys' clubs, girls' clubs, and home economics.

A detailed financial statement of the expenditure of all the extension funds from the States has been submitted and approved.

The legislatures in all of the Southern States have assented to the conditions of the Smith-Lever Act, and the majority of them have made provision to offset the Federal Smith-Lever funds apportioned to the States up to the present time.

The county agents in all States are financed partly from local funds and partly from funds furnished by the extension divisions of the colleges and the United States Department of Agriculture.

[1] This does not include $61,621.16 spent by the department in its general work of administration and demonstration not allotted to any State. The amount given was spent in State projects.

Table III shows dates of governors' and legislatures' assents to the Smith-Lever Act, also date of signing general memorandum of understanding, and to whom the Federal funds are to be paid in the States.

TABLE III.—*Dates of assent to Smith-Lever Act and signing of general memorandum of understanding and State recipients of funds.*

State.	Date of governor's assent.	Date general memorandum signed.	Legislature assented.	Recipient of funds.
Alabama	May 22, 1914	July 6, 1914	Jan. 29, 1915	Trustees Alabama Polytechnic Institute.
Arkansas	May 21, 1914	July 16, 1914	Mar. 27, 1915	College of Agriculture, University of Arkansas.
Florida	May 16, 1914	June 22, 1914	May 25, 1915	Board of control, University of Florida.
Georgia	May 20, 1914	June 15, 1914	Aug. 14, 1915	Trustees University of Georgia.
Kentucky	June 16, 1914	July 2, 1914	Mar. 15, 1916	University of Kentucky.
Louisiana	June 11, 1914	July 23, 1914	June 11, 1914	Administrators Louisiana State University and Agricultural and Mechanical College.
Maryland	June 4, 1914	July 15, 1914	Apr. 18, 1916	Trustees of Maryland State College of Agiculture.
Mississippi	May 27, 1914	June 28, 1915	Apr. 3, 1916	Trustees of Mississippi Agricultural and Mechanical College.
North Carolina	June 10, 1914	Sept. 4, 1914	Mar. 5, 1915	Trustees North Carolina College of Agriculture and Mechanic Arts.
Oklahoma	May 22, 1914	Aug. 27, 1914	Feb. 10, 1915	Trustees Oklahoma Agricultural and Mechanical College.
South Carolina	June 1, 1914	July 23, 1914	Feb. 12, 1915	Trustees Clemson Agricultural and Mechanical College.
Tennessee	May 28, 1914	Aug. 3, 1914	Jan. 29, 1915	Trustees University of Tennessee.
Texas	June 27, 1914	June 22, 1914	.....do.....	Business manager and treasurer, Texas Agricultural and Mechanical College.
Virginia	May 19, 1914	June 30, 1914	Jan. 26, 1915	Trustees Virginia Agricultural and Mechanical College and Polytechnic Institute.
West Virginia	June 4, 1914	July 2, 1914	Feb. 1, 1915	State Board of Control.

PROOF OF PRACTICAL SERVICE.

There are some significant figures in the financial reports for the fiscal year ending June 30, 1915, to which attention should be called. The Southern States contain 45.9 per cent of all rural inhabitants in the United States. They contain 48.5 per cent of all farms, as shown by the census of 1910, and 49.8 per cent of all males over 10 years of age engaged in agriculture. During the fiscal year in question the total sum from all sources expended in cooperative extension work in these States was $1,546,311.10. Of this sum 85 per cent was expended for salaries, 11.2 per cent for travel, and 3.8 per cent for miscellaneous expenses. As to projects, of the total sum expended 5.5 per cent was for administration, 64 per cent for county agents in agriculture, 14.2 per cent for county women agents in home economics and girls' work, 5.4 per cent in boys' clubs, and 10.9 per cent for movable schools, publications, specialists, and all other work. Eighty-three and six-tenths per cent was expended on the three main, practical projects, namely, county agents, women county agents, and club work for boys and girls. In the South there are 71 per cent of all county agricultural agents in the United States.

In the work for farm women and girls there are 15 State agents, or leaders, 21 assistants, 14 specialists, and 350 county women agents.

TABLE IV.—*Number of counties with home-demonstration agents and expenditures for home-demonstration agent work for the fiscal year ended June 30, 1915, for the South.*

State.	Number of agricultural counties.	Number of counties with agents.		Total expenditures.	Salaries.	Travel.	Other expenses.
		July 1, 1914.	July 1, 1915.				
Alabama	67	18	19	$16,155.87	$12,707.42	$2,555.84	$892.61
Arkansas	75	15	20	11,261.96	10,219.12	1,042.84	.....
Florida	50	24	27	22,211.80	18,391.75	3,817.41	2.64
Georgia	152	29	48	14,222.39	12,533.33	1,689.06	.....
Kentucky	120	9	19	15,732.92	13,717.37	1,967.55	48.00
Louisiana	64	13	13	9,058.62	7,201.38	1,857.24	.....
Maryland	23	5	6	4,102.30	2,523.33	1,008.53	570.44
Mississippi	80	33	33	18,553.26	15,410.48	2,933.86	208.92
North Carolina	100	27	34	25,719.25	24,605.43	1,086.76	27.06
Oklahoma	77	19	24	11,123.29	10,486.21	637.08	.....
South Carolina	44	21	24	20,565.40	16,405.84	4,159.56	.....
Tennessee	96	18	24	12,231.90	10,530.82	1,701.08	.....
Texas	250	26	27	17,040.80	14,352.95	2,510.88	176.97
Virginia	100	17	22	15,438.47	13,066.41	2,266.89	105.17
West Virginia	55	5	10	7,631.08	5,671.25	1,229.14	730.69
Total	1,353	279	350	221,049.31	187,823.09	30,463.72	2,762.50

The total expenditures for the entire United States for home economics is $316,778.09, of which $221,049.31, or 69.7 per cent, was expended in the Southern States.

THE COUNTY AGENT.

The county agent is considered the fundamental part of all extension work in every State. It is contemplated in each State to place both a man and woman agent in every county as soon as sufficient funds can be obtained and the demand for the work in the county develops. It is intended that the county agent shall be the leader of all agricultural work in his county. The specialist and other agricultural workers who wish to locate demonstrations or conduct extension work of any kind in the county must cooperate with the agent. The scope of the county agent's work has been extended to cover all phases of farm activities. The standard of qualifications and the personnel of agents is being rapidly advanced. The county agent is required to submit a definite outline of plan of work, which has been developed in conference with the director, State agent, and the specialist where any special work is involved. This will make his work more effective, avoid mistakes, and prevent the inexperienced agent from devoting too much of his time to one phase of his work at the expense of others just as important. The original idea of having definite, concrete demonstrations with the staple crops, scattered at convenient points throughout the county, is maintained. These demonstrations are in charge of the farmer,

who agrees to carry out the instructions of the agent on a certain acreage and make definite reports of the results at the end of the season. Besides the crop demonstrations, special demonstrations along various lines are added. The agent and specialist give advice and instructions to the farmers throughout the county on the various problems that come up from time to time. One of the vital points which the administrative officers impress on the agent is that he is the servant of all the people of the county. He must not allow himself to be made a convenience of by a few selfish or influential citizens. It has also been found that to serve all the people in the county the agent must work through local organizations and in every community have a leader, who might be termed an assistant. Where there is no organization the demonstration plat is used as a community center, about which the farmers collect to receive instructions at the time of the agent's regular visit.

As a rule, the county-agent work in the South is supported almost entirely from public funds and not from private subscriptions. Rarely, if ever, is it supported by membership fees or dues paid by members of any organization, such as a farm bureau.

The organization work in the Southern States begins with community organizations. If there are existing organizations already in communities, the county agent endeavors to work with them. Many county agents have created community organizations. More than 1,600 such community organizations were formed during the year 1915 by the county agents. Not all county agents are equally successful in perfecting rural organization, but the tendency to utilize organizations by communities is rapidly increasing.

These community organizations are generally simple in character, involving little or no expense at first, and confine their main efforts to demonstrating improved methods of agriculture, assembling at demonstrations, and continuing the regular meetings throughout the year to perfect plans for the improvement of agricultural, educational, and economic conditions in the community. In all of their work they are generally assisted by the county agent.

In quite a number of counties some sort of a county organization has been created and is helpful to the county agent in his work. This county organization generally consists of representatives from the community or farmers' organizations of the county, meeting with the county agent and representatives of business men's organizations, in some cases, and often with the county superintendent of education and others. These county councils are growing in favor in a number of the States. In Kentucky and Tennessee community organizations are increasing rapidly and county councils or agricultural societies composed of representatives of these community organizations are being perfected. From these are being formed divisional and State organizations.

In West Virginia the law requires the organization of some county association of farmers before taxes can be paid for the salary of a county agent, and these county agricultural societies or bureaus have seen the importance of community organizations. More than 180 such community organizations were formed during the year 1915, and the county organization is rapidly being changed into a representative body of members from local organizations.

In Oklahoma a recent law providing for free agricultural fairs on community and county basis has furnished the machinery for an interesting experiment in local organization. In some counties local organizations of farmers already in existence, such as the Farmers' Union, play an important part in supporting the work of the county agent.

In all of his work the county agent in the South pins his faith to demonstrations conducted by the farmer. These are carefully planned and thoroughly worked out. They form the nucleus for all other lines of work and have been the most potential influence in agricultural improvement in the Southern States.

County agents in the South do not confine their work to the membership in any organization whatever. Feeling that they are public officers, they hold themselves free to work with all classes of people. In no case are they permitted to serve only the members of any county farm bureau or other organization of that character. As a rule, the plans are so laid in each county that some work is done with poor farmers as well as with average and good farmers. It should be said to the credit of the county agents of the South that most of them give instruction to and carry on demonstrations with negro farmers and tenants as well as with white farmers.

Special campaigns are conducted by the extension division through the county agents whenever it is deemed advisable. In 1914 a diversification campaign was organized and pushed vigorously by the entire force in the cotton section. This resulted in an average reduction of 15 per cent of the cotton acreage. This campaign also resulted in an enormously increased acreage of corn, small grain, feed crops, and cover crops for soil building. The business men, bankers, railroad officials, and all State and local organizations aided in this diversification campaign, which resulted in making the South more nearly self-supporting than it has been in 50 years. Similar campaigns have been carried on for hog-cholera control, tick eradication, etc. The campaigns for hog-cholera control and tick eradication have been in cooperation with specialists from the Bureau of Animal Industry, United States Department of Agriculture, and live-stock sanitary boards of the various States. Crop records of demonstrations in corn and cotton, the two leading crops, have been kept for several years, and one for oats for two years.

TABLE V.—*Number of farmers demonstrating, number of acres demonstrated, and average yield of corn per acre on demonstrations in the Southern States in 1915.*

State.	Number of farmers demonstrating.	Number of acres demonstrated.	Average yield per acre on demonstrations (bushels).	State.	Number of farmers demonstrating.	Number of acres demonstrated.	Average yield per acre on demonstrations (bushels).
Texas	8,117	68,392	33.5	South Carolina	.....	19,530	29.5
Oklahoma	5,275	75,211	44.0	North Carolina	9,922	29,898	45.0
Louisiana	2,816	35,166	32.8	Virginia	5,227	33,077	48.6
Arkansas	8,096	67,788	36.6	West Virginia	771	1,351	54.0
Tennessee	878	14,614	42.1	Kentucky	1,961	24,831	51.0
Mississippi	706	12,697	39.7	Maryland	243	2,055	47.9
Alabama	4,850	46,198	36.2				
Florida	1,777	14,706	24.7	Total and average.	55,671	480,148	37.77
Georgia	5,032	34,634	36.3				

TABLE VI.—*Average yields of corn under demonstration methods and State yields for the years 1910 to 1915, inclusive.*

State.	Average yields under demonstration methods (bushels).						Bureau of Crop Estimates figures for the States (bushels).					
	1910	1911	1912	1913	1914	1915	1910	1911	1912	1913	1914	1915
Eastern Texas	34.1	21.4	33.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western Texas	31.5	23.1	29.7	.....	.....	.....	.....	.....	.....	.....	.....	.....
Texas	32.8	22.3	30.9	32.9	30.9	33.5	20.6	9.5	21.0	24.0	19.5	23.5
Oklahoma	24.1	13.0	37.2	28.1	25.2	44.0	16.0	6.5	18.7	11.0	12.5	29.5
Louisiana	32.5	28.6	28.7	29.2	30.8	32.8	23.6	18.5	18.0	22.0	19.3	20.5
Arkansas	36.8	32.9	33.2	35.7	28.7	36.6	24.0	20.8	20.4	19.0	17.5	23.0
Tennessee	.....	46.6	49.7	40.1	36.6	42.1	.....	26.8	26.5	20.5	24.0	27.0
Mississippi	41.6	32.4	41.9	41.9	39.3	39.7	20.5	19.0	18.3	20.0	18.5	19.0
Alabama	41.4	46.3	44.1	40.0	37.4	36.2	18.0	18.0	17.2	17.3	17.0	17.0
Florida	23.0	30.9	24.8	31.7	26.8	24.7	13.0	14.6	13.0	15.0	16.0	15.0
Georgia	35.4	39.2	35.6	35.6	37.0	36.3	14.5	16.0	13.8	15.5	14.0	15.0
South Carolina	41.0	39.2	41.6	39.4	36.6	29.5	18.5	18.2	17.9	19.5	18.5	16.5
North Carolina	43.4	42.6	42.6	45.1	45.9	45.0	18.6	18.4	18.2	19.5	20.3	21.0
Virginia	46.5	41.9	42.1	48.1	45.7	48.6	25.5	24.0	24.0	26.0	20.5	28.5
Maryland	.....	.....	47.1	40.5	56.0	47.9	.....	.....	36.5	33.0	37.0	35.0
Kentucky	.....	.....	.....	37.3	42.4	51.0	.....	.....	.....	20.5	25.0	30.0
West Virginia	.....	.....	.....	.....	37.8	54.0	.....	.....	.....	.....	31.0	31.5
Average for States represented	35.3	33.2	35.4	35.9	34.8	37.7	19.3	15.8	19.6	20.2	20.7	23.4
Average for United States	.....	.....	.....	.....	.....	.....	27.7	23.9	29.2	23.1	25.8	28.2

TABLE VII.—*Number of farmers demonstrating, number of acres demonstrated, and average yield of cotton per acre on demonstrations in the Southern States in 1915.*

State.	Number of farmers demonstrating.	Number of acres demonstrated.	Average yield per acre on demonstrations (pounds seed cotton).	State.	Number of farmers demonstrating.	Number of acres demonstrated.	Average yield per acre on demonstrations (pounds seed cotton).
Texas	4,103	37,732	1,165	Florida	411	1,907	656
Oklahoma	2,261	21,472	914	Georgia	1,478	9,540	1,350
Louisiana	860	24,795	1,035	South Carolina	.....	14,618	1,437
Arkansas	4,576	40,116	1,048	North Carolina	1,445	13,180	1,483
Tennessee	1,008	2,218	1,029	Virginia	160	736	1,288
Mississippi	363	11,679	1,244				
Alabama	3,580	40,817	1,077	Total and average.	20,245	218,810	1,180

TABLE VIII.—*Average yields of cotton under demonstration methods and State yields for the years 1910 to 1915, inclusive.*

State.	Average yield under demonstration methods (pounds seed cotton).						Bureau of Crop Estimates figures for the States (pounds seed cotton).					
	1910	1911	1912	1913	1914	1915	1910	1911	1912	1913	1914	1915
Eastern Texas	826.1	1,074.5	1,108.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western Texas	578.4	699.4	791.3	.....	.....	.....	.....	.....	.....	.....	.....	.....
Texas	710.4	849.9	862.4	752.9	924.4	1,165	447	576	618	450	549	447
Oklahoma	708.1	628.7	977.7	610.5	1,046.4	914	585	504	552	396	636	465
Louisiana	785.5	1,063.5	977.6	795.8	819.3	1,035	390	522	591	510	486	474
Arkansas	915.3	946.7	1,024.3	1,048.6	1,033.6	1,048	525	558	570	615	591	525
Tennessee	.....	1,672.9	1,131.3	1,276.7	1,220.8	1,029	.....	744	513	630	588	543
Mississippi	933.5	1,045.0	924.9	1,308.4	1,125.6	1,244	519	510	531	612	588	510
Alabama	1,220.4	1,442.9	1,285.0	1,236.1	1,306.5	1,077	474	609	519	570	627	444
Florida	572.0	840.4	716.3	863.0	970.3	656	330	384	357	450	555	363
Georgia	1,298.0	1,510.0	1,344.4	1,284.1	1,338.2	1,350	522	732	489	624	708	579
South Carolina	1,249.3	1,569.2	1,315.4	1,307.3	1,295.8	1,437	636	795	657	705	768	693
North Carolina	1,332.7	1,591.5	1,358.0	1,185.8	1,452.8	1,483	681	861	813	717	849	810
Virginia	.....	1,414.3	1,500.5	901.3	1,467.8	1,288	.....	912	798	720	762	636
Average for States represented	858.9	1,081.8	1,054.8	1,004.9	1,044.77	1,180	.....	.....	.....	.....	.....	.....
Average for United States	.....	.....	.....	.....	.....	.....	512.1	624.6	579.6	546.0	623.7	517.5

NOTE.—The lint cotton estimate has been multiplied by 3 to determine the estimated yield in seed cotton.

TABLE IX.—*Number of farmers demonstrating, number of acres demonstrated, and average yield of oats per acre on demonstrations in the Southern States in 1915.*

State.	Number of farmers demonstrating.	Number of acres demonstrated.	Average yield per acre on demonstrations (bushels).	State.	Number of farmers demonstrating.	Number of acres demonstrated.	Average yield per acre on demonstrations (bushels).
Texas	.....	.....	.....	Georgia	1,466	7,683	40.0
Oklahoma	371	10,923	42.0	South Carolina	.....	24,164	20.3
Louisiana	735	34,205	41.0	Virginia	688	7,514	33.6
Arkansas	873	5,356	33.9	Kentucky	286	2,148	38.5
Tennessee	.....	.....	.....	Maryland	55	458	42.0
Mississippi	271	6,831	27.3	West Virginia	26	145	41.0
Alabama	2,362	34,153	32.0				
Florida	513	4,595	25.0	Total and average.	7,646	138,175	35.19

TABLE X.—*Average yield of oats under demonstration methods and State averages for 1914 and 1915.*

State.	Average yield under demonstration methods (bushels).		Bureau of Crop Estimates figures for the States (bushels).	
	1914	1915	1914	1915
Texas	43.7	.....	25.0	35.5
Oklahoma	44.7	42.0	27.5	27.0
Louisiana	40.9	41.0	23.0	25.0
Arkansas	35.4	33.9	24.0	27.0
Tennessee	38.4	.....	23.0	24.5
Mississippi	39.9	27.1	23.0	21.5
Alabama	43.5	32.0	22.0	19.0
Florida	32.3	.....	18.0	20.0
Georgia	47.5	40.0	20.0	19.5
South Carolina	43.3	20.3	20.0	19.0
Virginia	38.4	34.9	15.5	25.0
Kentucky	32.5	38.5	21.0	26.0
Maryland	32.0	42.0	27.0	34.0
Average for States represented	43.05	35.19	22.2	24.8
Average for United States	.....	.....	29.7	37.8

TABLE XI.—*Total yield of corn, oats, wheat, and hay in the 11 cotton States of Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas for the years 1909 to 1915, inclusive.*

Year.	Bushels of corn.	Bushels of corn.[1]	Bushels of oats.	Bushels of wheat.	Tons of hay.
1909	461,536,000	291,755,000	51,847,000	28,622,000	3,108,000
1910	664,752,000	432,912,000	90,577,000	55,120,000	3,428,000
1911	539,136,000	432,898,000	65,506,000	34,619,000	2,611,000
1912	685,333,000	430,155,000	90,659,000	46,829,000	4,295,000
1913	658,252,000	442,802,000	97,237,000	51,009,000	4,214,000
1914	610,851,000	436,051,000	102,685,000	35,188,000	4,577,000
1915	812,883,000	513,908,000	157,714,000	88,842,000	6,269,000

[1] Second column gives total production of corn for States named above other than Texas and Oklahoma.

TABLE XII.—*Number of adult farmers enrolled in farmers' cooperative demonstration work (extension work) since its beginning in 1904 until 1915, inclusive.*

State.	1904[1]	1905[1]	1906[1]	1907[1]	1908	1909	1910	1911	1912	1913	1914	1915
Texas	.....	.....	.....	.....	8,682	15,307	19,039	21,806	23,095	22,554	23,062	18,326
Oklahoma	.....	.....	.....	.....	4,141	5,172	8,269	11,617	15,162	16,486	13,731	15,049
Louisiana	.....	.....	.....	5,698	2,859	5,337	6,155	6,102	6,116	6,051	6,603	6,348
Arkansas	.....	.....	.....	.....	5,209	8,125	11,306	15,720	15,398	15,623	15,132	14,871
Mississippi	.....	.....	.....	.....	4,070	4,556	3,043	4,381	6,087	5,181	3,865	3,333
Alabama	.....	.....	.....	.....	2,598	4,228	4,679	8,568	10,332	10,435	11,358	11,931
Georgia	.....	.....	.....	.....	468	1,830	3,582	5,120	5,444	5,431	5,004	4,647
Florida	.....	.....	.....	3,775	.....	86	845	1,628	3,181	3,565	2,453	3,597
South Carolina	.....	.....	.....	.....	1,006	1,569	2,625	3,600	4,288	4,105	4,021	4,415
North Carolina	.....	.....	.....	.....	2,163	3,983	6,388	7,871	8,075	8,096	8,531	10,346
Virginia	.....	.....	.....	.....	1,314	1,958	1,670	3,122	4,153	4,130	4,644	6,053
Maryland	.....	.....	.....	.....	.....	.....	.....	.....	275	275	353	393
Tennessee	.....	.....	.....	.....	.....	.....	299	229	654	786	2,141	2,787
Kentucky	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	758	2,355
West Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	426	1,071
Total	4,000	6,000	8,000	9,473	32,510	52,151	67,900	89,764	102,260	102,718	102,082	105,522

[1] Estimate, no records available to show the actual number in each State.

The average yield on all the demonstration acres has almost doubled the States' average yield of these crops. Since the establishment of the demonstration work in the cotton States the States' average yield on staple crops has been greatly increased. The special efforts made throughout the cotton section for the improvement of pastures and live stock have been most satisfactory.

The following summary shows the diversity of the county agents' work and also some of the results, as taken from 1915 reports: There were enrolled 105,522 adult farmers. There were 218,810 acres in cotton demonstrations, giving an average yield of 1,180 pounds seed cotton. There were 480,148 demonstration acres in corn, giving an average yield of 37.7 bushels per acre; 138,175 acres in oats, giving an average yield of 35.19 bushels, 82,758 acres in wheat, giving an average yield of 22.13 bushels; 24,265 acres in alfalfa, 10,520 acres in red clover 43,381 acres in crimson clover; 5,024 acres in vetch; 9,348 acres in lespedeza; 142,873 acres in cowpeas; 8,322 acres in soy beans; 14,475 acres in peanuts; 9,984 acres in velvet beans; 30,058 acres in rye demonstrations; 2,548 acres in Sudan grass; 43,769 acres in mixed grasses for hay; 25,245 acres in miscellaneous forage-

crop demonstrations; 9,080 acres in Irish potatoes, 9,692 acres in sweet potatoes; 5,441 demonstration orchards with 488,953 trees. Assistance was given in spraying, pruning, and caring for 20,810 orchards, with a total of 2,216,008 trees. Through the influence of the agents and specialists the following pure-bred animals were brought into the States: Horses, 1,776; dairy cattle, 4,331; beef cattle, 5,091; hogs, 19,886; sheep and goats, 1,427. Farmers have been induced to treat for diseases and pests 1,023,908 head of cattle; hogs (vaccinated for cholera), 411,843; sheep, 5,135; horses, 17,952. The agents themselves treated 249,816 head of hogs for cholera. Assistance and advice were given in the erection of 3,632 buildings, 1,092 water systems were installed, 748 home-lighting systems, 18,248 houses screened, 11,616 flytraps installed, 1,544 telephone systems, 6,715 new pastures, 21,719 acres tile drained, 199,877 acres drained by ditches, stumps removed on 71,819 acres, 202,706 acres of land terraced, 29,319 home gardens started, 264,875 acres in cover crops for soil improvement, 64,079 new implements bought, 1,863 dipping vats constructed, and 4,656 silos; 2,907 farmers instructed in the care of farm manure; 8,699 farmers were induced to use lime; 110,590 were instructed in the use of fertilizers; 678 communities were organized for buying fertilizer cooperatively; community clubs organized at the suggestion of the agents, 1,712, with a membership of 44,548. Agents made 612,255 visits and traveled 3,051,750 miles, and 203,617 farmers called at the agents' offices; 16,010 meetings were held under the auspices of the agents. The total attendance at these meetings was 1,217,113. Department bulletins distributed by agents, 1,035,608; extension and college bulletins, 247,622; number of farmers induced to field-select seed, 43,837.

CLUB WORK.

BOYS' CLUBS.

Another project in all the States and coming into close connection with the county agents' project is that for the boys' club work, which has developed into a very important branch of the whole organization. The following outline of this work will show the rapid progress it has made since it was first established and also some of the remarkable results accomplished by members of these clubs. Many members of the first clubs have grown to be men and are now listed as demonstrators in the men's work.

The boys' club work in the Department of Agriculture was first organized in Holmes County, Miss., in 1907. During the year 1908 these organizations were extended into several counties in the State and in two or three other States. In 1909 a systematic effort was made by agents of the farmers' cooperative demonstration work to organize a few counties in every Southern State; 10,543 members

were enrolled in corn clubs that year. In 1910, 46,225 were enrolled; in 1911, 54,362; in 1912, 59,550; and in 1913, 91,196. Upon investigation by the department, it was found that many boys had enrolled in the clubs, but had failed to do the work. Their names had, however, been left on the rolls from year to year. Means were adopted in 1914 to enroll only those boys who would do the work. In 1914, 53,580 were enrolled in all the clubs, and in 1915, 62,842.

During the seven years in which the corn clubs have been conducted by the department and cooperating agencies, 2,007 boys have produced more than 100 bushels of corn to the acre. Of this number 27 have produced more than 200 bushels per acre.

Results of corn clubs for the years 1913, 1914, and 1915 are shown in Table XIII.

Table XIV shows yearly enrollment in boys' clubs by States:

TABLE XIII.—*Results of boys' corn-club work for 1913, 1914, 1915.*

State.	1913			1914			1915			Moisture content.	
	Number of boys reporting.	Average yield per acre (bushels).	Average cost per bushel.	Number of boys reporting.	Average yield per acre (bushels).	Average cost per bushel.	Number of boys reporting.	Average yield per acre (bushels).	Average cost per bushel.	No. of tests.	Average for 3 years (per cent).
Alabama	755	57.02	$0.399	615	51.32	$0.46	903	55.73	$0.37	123	15.7
Arkansas	760	45.0	.365	502	38.92	.409	583	45.3	.35	23	14.7
Florida	246	46.25	.503	299	35.07	.537	589	37.55	.48	5	13.5
Georgia	3,000	52.0	.46	2,295	52.4	.42	2,073	45.0	.42	73	15.4
Kentucky	93	63.0	.35	94	64.94	.298	247	67.8	.307	13	17.9
Louisiana	279	55.0	.....	366	45.7	.37	409	51.06	.374	14	14.1
Maryland	35	59.6	.3066	54	52.45	.334	119	59.3	.338	1	16.4
Mississippi	316	58.8	.50	599	54.49	.431	764	49.73	.474	63	14.3
North Carolina	670	62.4	.37	966	58.2	.437	1,318	53.2	.436	103	15.9
Oklahoma	866	48.0	.28	426	36.9	.342	469	47.3	.297	6	13.1
South Carolina	489	59.75	.4023	536	56.63	.435	466	47.26	.427	25	16.3
Tennessee	641	56.3	.33	277	62.69	.354	509	50.89	.366	7	15.0
Texas	333	47.05	.315	270	39.9	.373	459	35.5	.325	5	13.4
Virginia	775	68.5	.25	712	63.52	.357	670	54.96	.362	90	18.6
West Virginia	151	76.54	.2987	117	66.99	.349	331	70	.277	13	18.0

TABLE XIV.—*Enrollment in boys' demonstration work.*

State.	1909	1910	1911	1912	1913	1914	1915
Alabama	392	2,254	5,444	10,000	13,905	3,750	6,895
Arkansas	1,564	3,663	3,934	2,675	6,500	2,745	3,454
Florida	.....	.....	827	1,200	1,750	1,898	1,675
Georgia	346	3,271	5,293	11,900	13,750	10,254	11,216
Kentucky	.....	93	104	.....	.....	1,211	2,308
Louisiana	1,129	6,696	4,627	2,125	4,135	5,299	4,084
Maryland	.....	.....	.....	.....	200	217	335
Mississippi	2,201	6,492	4,642	4,825	7,190	2,428	5,965
North Carolina	347	2,878	3,754	3,200	4,525	4,848	4,424
Oklahoma	2,036	5,242	7,259	6,200	10,475	4,597	6,251
South Carolina	305	1,741	1,411	2,200	2,975	1,759	1,358
Tennessee	.....	1,685	1,664	2,600	3,950	1,958	1,500
Texas	1,761	10,241	13,760	10,375	17,825	8,752	7,028
Virginia	462	1,969	1,643	2,250	4,016	3,108	2,724
West Virginia	.....	.....	.....	.....	.....	756	3,625
Total	10,543	46,225	54,362	59,550	91,196	53,580	62,842

EVOLUTION OF THE WORK OF BOYS' CLUBS.

After the corn clubs were firmly established, pig clubs and baby-beef clubs were organized by the Bureau of Animal Industry, in cooperation with the States Relations Service. This coordination of plant clubs and animal clubs led to two-year rotation in club work. On one acre the boys grew corn and on a second acre feed crops, such as peanuts, soy beans, potatoes, cereals, and clovers for animals. In order to teach the growing of these crops, clubs for growing them were established. When the boy has practiced the two-year rotation with corn, legumes, and pigs, and has learned the lesson of soil improvement and the value of feeding his crops to animals, he is advanced to the next class. This class is called the four-crop club. The boy takes 3 acres and establishes a three-year rotation of the standard crops grown in his State. Splendid results have been secured with the following crops on 3 acres: Corn, cotton, oats, followed by cowpeas. The boys are urged to plant their acres to winter cover crops to be used for the grazing of their animals in the winter and early spring and for turning into the soil for manurial purposes before the planting of their next crops. The boys doing club work have been divided into classes, as follows: Boys engaged in one activity are placed in class A; two activities, class B; three activities, class C, and so on.

In some sections of the territory clubs are formed to cultivate 5 acres. Boys who will not attend school are urged to join these clubs, but schoolboys are urged to engage only in activities that will not interfere with their school work.

To meet the needs of a large percentage of the population served by the Office of Extension Work in the South, farm-makers' clubs have been inaugurated for negro boys. The unit of acreage for these clubs is 1 acre. The boy plants one-half acre in corn, one-fourth acre in potatoes, and one-fourth acre in peanuts. These crops may be changed to meet local conditions. The idea of farm-makers' clubs is to teach the growing of food crops. Here, again, the boys are taught to grow summer legumes in their crops when practicable, and winter legumes for the purpose of grazing animals and soil improvement.

CANNING-CLUB AND HOME-DEMONSTRATION WORK.

Under this heading is included all girls' club work and all home-demonstration and home-economcis work for women.

In speaking to a State teachers' association in the South in 1907, Dr. Seaman A. Knapp used the following language: "These half-grown boys and girls could make a garden and raise the fruit and poultry to support the family if they would. It might brown their

skins and soil their hands, but it would help them to do something and to know something. It would aid the family pocketbook and help the family character." He also said: "A country home, be it ever so plain, with a father and mother of sense and gentle culture, is nature's university, and is more richly endowed for the training of youth than Yale or Harvard." That was three years before the girls' club work was organized. In the same wise and prophetic address he said: "That nine-tenths of all sickness is due to malnutrition, which is another name for ignorance." As the work for women and girls develops it becomes more and more clear that it was wise to lay the foundation by making demonstrations which are affecting the diet of the people.

The girls' demonstration work began in 1910 with the canning clubs in three counties in Virginia and one in South Carolina. In 1911 there were 21 agents and more than 3,000 girls. In 1912 there were 149 agents and about 23,000 girls; 1913, 199 agents and 33,060 club members. Table XV shows yearly enrollment of girls' clubs by States.

TABLE XV.—*Number of girls enrolled in clubs under farmers' cooperative demonstration work (extension work) since their beginning in 1911 until 1915, inclusive.*

State.	1911	1912	1913	1914	1915
Texas	.....	1,933	3,400	3,210	6,336
Oklahoma	123	4,425	4,000	2,274	5,213
Louisiana	301	2,355	3,725	4,179	2,974
Arkansas	36	925	1,200	1,457	2,419
Mississippi	258	2,117	3,600	2,387	4,133
Alabama	98	2,400	3,725	2,934	1,640
Georgia	1,556	2,186	3,150	4,103	5,000
Florida	.....	534	1,050	2,194	1,838
South Carolina	459	1,575	3,035	2,500	3,453
North Carolina	83	520	1,200	1,500	3,392
Virginia	224	560	1,150	2,197	1,819
Maryland	.....	.....	.....	297	607
Tennessee	15	770	3,825	2,157	3,403
Kentucky	.....	.....	.....	923	1,272
West Virginia	.....	.....	.....	861	2,082
Total	3,153	20,300	33,060	33,173	45,581

The enrollment for 1914 was 33,173 in the 15 Southern States in charge of 365 agents. Of these club members, 7,793 put up 6,091,237 pounds of tomatoes and other vegetables from their tenth-acre gardens. These products were put up into 1,918,024 cans, jars, and other containers. They are estimated to be worth $284,880.81, and nearly $200,000 of this is profit. The average profit per member was $23.30. Furthermore, these girls put up thousands of dollars' worth of other products from the farms and orchards.

Special work was done with peaches, berries, figs, scuppernongs, mayhaws, oranges, kumquats, and many other fruits of the South.

Nearly 3,000 girls joined the poultry clubs, and several hundred did fine work in bread clubs. Many of the best trained club members succeeded with winter gardens. In all of these activities the women on the farm have given active help. Fiscal officers, school officers, and teachers have cooperated in many ways.

In 1915 there were 387 agents and 45,581 girls enrolled in the different clubs for girls in the Southern States; 32,613 cultivated tenth-acre gardens. All of them grew tomatoes as their main crop. Many second-year girls grew beans, peppers, or okra; some third-year girls added still another crop suitable to their localities. Fourteen thousand eight hundred and ten girls submitting reports harvested 5,023,305 pounds of tomatoes and packed 2,166,515 cans, jars, and glasses with vegetables and fruits. In addition, they put up ketchup, soups, preserves, jellies, and marmalades. Nine thousand eight hundred and fifty-four girls raised poultry, 3,062 made special bread demonstrations, and 923 grew winter gardens.

The club members not only do healthful work in the open air, but they save thousands of dollars' worth of surplus products grown on the farms. There is an advantage in unifying the work and carrying out a systematic program in all the clubs in the different States. Domestic science and sanitation are approached indirectly and taught most effectively. A girl who succeeds with her garden and with her canning and preserving takes pleasure in making her uniform cap and apron, and she naturally desires to learn more about cooking and sewing. She is zealous, too, about cleanliness and sanitation in general, because these things are so necessary in maintaining high standards of quality in the products she exhibits, uses, or sells. More domestic science is taught by demonstration than is possible through ordinary dogmatic and academic instruction.

The garden work for the girls has recently been graded. First-year girls grow tomatoes only; second-year girls divide their gardens in half and grow tomatoes and one other crop. The second crop is to be selected by the State agent in charge of the work. Third-year girls divide their gardens into three parts, and the third vegetable is selected by the county agent and the county club. This expansion will be continued as rapidly as the progress indicates to the leaders the need for it.

The cooperative work carried on by the Office of Farmers' Cooperative Demonstration Work and certain colleges of the South has from the beginning emphasized the plan of organization which provides for an efficient, devoted woman county agent, employed for as long a term as possible and instructed and supervised by the State agent. This plan of personal leadership and supervision is the basis of all successful work. The time of employment of the county agent has increased from a few months at first until now many work 8 to

12 months in the year. The ideal is a well-trained, efficient woman agent in every county, employed for the entire year. This plan will be pushed as rapidly as possible. After the girls' club work becomes well established in the county and the agent's efficiency proved, demonstration work for women is developed.

The girls' club work has opened the doors of the homes for the agents to do demonstration work among the adult women. It has been a process of evolution along natural lines. Many of the women county agents are using the canned products put up by the girls and the poultry which have been grown by the mothers to demonstrate simple, useful lessons in cooking. In some counties the agents have already enrolled 75 to 100 women demonstrators, and each one has a homemade fireless cooker. Creole chicken has been the first lesson, because in preparing it both garden and poultry products are needed. Some agents have been successful in having the women demonstrators do egg grading and form egg-selling associations.

Following the work with garden and poultry products the agents easily get to demonstrations in bread making and also in butter making. Incidental teaching in sewing comes in in making uniform caps, aprons, and dresses. The girls make these things and embroider the 4–H club emblem upon them. Of course, the mothers help. Since the very beginning of the work the idea of mothers' cooperation has been used with great success. In all the home work the agents have familiarized themselves with the most useful conveniences and helpful utensils, especially those that can be made at home. The whole program naturally leads to home sanitation and beautification. It is easy for an agent who has the confidence of the girls and their mothers to get fly screens put in, and even to install simple and inexpensive water works. It has been found most desirable to follow a well-defined program, but all along the line good agents find hundreds of opportunities to give advice and make suggestions which lead to better living. As a rule, the housewives look after the poultry on the average southern farm. Following out the idea of the proper use of meats, many agents have developed demonstrations in curing hams and making sausage. A great many groups of local women demonstrators have organized in order to conduct this work successfully. The woman county agents in 1915 enrolled 6,852 women who did definite lines of work prescribed for them.

The plan of the home-demonstration work contemplates study and demonstration in the utilization of the necessities of life. In order of development, the demonstrations have been made with vegetables, fruits, meats, bread, and butter. The women agents make or procure time and labor saving devices and conveniences for use in the home. They also get the women demonstrators to secure these things. Each device or convenience is impressed at the time when a specific prod-

uct is being prepared. For instance, fireless cookers are used in cooking the vegetables grown by the girls and the poultry grown by the women. Two thousand one hundred and eighty-one fireless cookers were made the first year. This plan was taken up generally. Iceless refrigerators, butter mixers, and butter molds are made when the agent is impressing the making of butter and the proper care of milk. Bread mixers and kitchen cabinets supplement the bread-demonstration work, and fly traps are made, houses screened, and running water installed in the home in connection with canning, preserving, and other phases of household work. The program goes on step by step until the agents give help in home equipment, home architecture, and home beautification. During the last year women demonstrators made 5,227 useful household devices and conveniences. These include iceless refrigerators, fly traps, wheel trays, floor mops, ironing boards, and scrubbing chariots. Women agents had 661 houses screened and 124 water-works systems installed.

SPECIALISTS.

One important branch of the extension division in each State, besides those of administration and the county agents' projects, is that of the specialist. Under this division are a number of projects with leaders assigned for each line of work that is to be carried on in the State. The specialists' work, as now being organized in the extension divisions, is a new feature at least in its relation to the county agents. Results will be apparent in proportion to the amount of thorough coordination of the work of specialists with that of the county agents. The important administrative problem is to get each part of the work to be a complement to the other and to secure that team work and mutual helpfulness between the specialists and the county agents which will lead to the largest possible usefulness on the part of both types of workers. The directors of extension should be extremely careful to secure men of recognized ability in their special lines. It is better to secure a few men of outstanding ability than have a large force of mediocre men who can not command the attention or confidence of the farmer. There is, in some places, a tendency to employ men who from point of age, experience, or ability should not be classed as specialists. Those in charge of the work should consider only the best possible service to the people on the farm and in the home. The difficulty of determining the real value of the service the specialist renders the people of the State should make the director feel sure the service is needed and doubly sure that he selects the right man. The primary duties of the specialist are to assemble material from the results of the work in the experiment stations, in the colleges, and in the Department of Agriculture, or

from any other reliable sources of information, for the use of the county agents and the farmers in the State, and to plan and carry out demonstrations through county agents to illustrate and secure the adoption of the improved practices.

The function of the specialist in the field should be to deal with the difficult and scientific problems that the county agent could not be expected to know about or to handle. His itinerary should be planned to conform with that of the county agent, and any special demonstrations to be carried out in the county should be planned cooperatively with the agent.

The specialists are to be used freely and in cases of emergency in all parts of the State. They are also expected to do the most of the lecturing or speaking in the movable schools and general agricultural meetings.

There are now employed in the extension division of the South 137 specialists. The largest number in any one line of work is for dairying, where they already have done a great deal in establishing cream routes, furnishing plans for dairy buildings, assisting the farmers in working out balanced rations for the dairy cow, promoting an interest in better dairy animals, helping to organize cow-testing associations, and in many other ways assisting the farmers and their wives in dairy improvement. They have also done much to encourage better pastures and the proper handling of the dairy output by way of looking into the shipping facilities, etc. Twenty-four specialists are employed in live-stock work and have done much in cooperation with the agents in working up an interest in the importation of pure-bred beef cattle, hogs, and other stock. They have gone with farmers to assist in selecting good live stock for breeding purposes, and have devoted considerable time to planning pastures and systems of rotation on the farm to make better provision for feeding and caring for the animals on the farm. Sixteen people have been engaged in rural-organization work and have assisted in organizing communities for mutual benefit. They have done a great deal to encourage better methods in the handling of farm products for market and in the buying of necessary articles cooperatively. The twelve horticulturists employed have, in cooperation with the county agents, encouraged the trucking and fruit interests of the sections in which these industries were prominent. Their special work has been to encourage home orchards and to teach the people how to care for same. They have also assisted in standardizing the product and in many ways given helpful suggestions and instructions, not only to the individual farmers but to horticultural and fruit-growing organizations. The eleven poultry specialists have done much to establish this industry on a better basis, confining their work principally to a few of the best poultry-raising counties in the

States. They have organized poultry clubs, egg-selling associations, etc. Eight are engaged in agricultural engineering. This number includes those who have assisted in drainage and farm buildings, the installation of home conveniences, etc. Seven have been employed in the market work in cooperation with the Office of Markets, and they have been of considerable assistance to people in certain communities in the way of locating articles for sale and finding suitable markets. There are 5 specialists in entomology, 5 in farm management, 3 in drainage, and 1 in sanitation, and quite a number are working in cooperative hog-cholera control work. There are a number of other people engaged in some kind of special extension work, and it is contemplated to increase this force as rapidly as funds are provided and the necessity for new lines becomes apparent.

The specialist should be careful to make full and complete reports of the work done, furnishing copies to all cooperating agencies. The work of the specialist is often so closely aligned with that of the county and district agents that the entire credit for results accomplished can not be claimed by either. The county agent arranges the preliminaries and cleans away the difficulties for the technical work of the specialists, and often looks after it in the specialist's absence, thereby giving the specialist more time for technical and scientific work. The county agent is to the specialist what the trained nurse is to the doctor.

NEGRO WORK.

Almost from the inception of the demonstration work much attention has been given to negro farmers. Quite a number of negro demonstrators and cooperators were listed with white agents, especially in thickly settled negro districts. Frequently when white demonstrators were listed the actual instruction given on their farms was to the negro tenants. Sometimes all of the tenants on the farm were assembled for instruction when the agent visited this demonstrator. It has been the policy of those in charge of the demonstration work in the South to put on negro agents in certain localities where the negro population predominated. As early as 1911 there was regularly organized negro work in 7 States in the South, with 23 agents. There is now organized work in 11 States, with 53 agents who devote their entire time to the negro farmers in their territory. More than $60,000 extension funds are being expended in paying the salaries of these agents. It is a conservative estimate that 25 per cent of all demonstration work in territory where there is a large negro population is spent in giving direct assistance to the negro farmers. The results from the assistance given the negroes through the demonstration agents have been very striking, and no doubt the progress that

has been brought about will be made permanent. The negro farmer and his family seem to be particularly susceptible to the system of instruction used in demonstration work. Whole negro communities have been reached by the work of an agent, as is readily observed by the improved condition of the farm, buildings, and live stock, and the general appearance of the entire family.

OUTLOOK.

The outlook for cooperative extension work in the South is, on the whole, distinctly encouraging. The work in every State is receiving the financial and moral support of the people. The demand for additional agents is greater in every State than can be supplied from the funds yet available. The efficiency of the entire force is being increased as rapidly as suitable men for county agents and specialists can be found. The coordination of all the extension work in the States is progressing. The proper relationship between all workers in the extension division is better understood, and the efforts of the supervisory force are being exerted to bring about harmony and satisfaction to all concerned. The county agents' plan of conducting agricultural and home-economics extension work is recognized as the most effective means of reaching the farming communities. It is thought that the influence of the work can be extended much more rapidly by the well-devised system of community-organization work now under way.

STATE REPORTS.

ALABAMA.

Division of Extension Work, Alabama Polytechnic Institute, *Auburn.*

J. F. Duggar, *Director.*

History.—The experiment station in Alabama was established in connection with the agricultural college of the Alabama Polytechnic Institute at Auburn, Ala., in 1883.

The State department of agriculture and industries in Alabama was established in 1888. The commissioner of agriculture, who is the administrative officer of this department, is elected by the people.

From the time the experiment station was established until the year 1897, some of the professors of the college of agriculture and members of the staff of the experiment station participated from time to time in farmers' meetings. The character of these meetings varied greatly. Most of the meetings of early years, in which the staff of the experiment station took part, were farmers' institutes. These have been conducted under two different auspices, namely, the experiment station and the State department of agriculture. The

State department of agriculture, which has no official connection with the Alabama Polytechnic Institute, has for many years conducted farmers' institutes from a fund provided by the legislature. In these institutes certain members of the experiment-station staff, by invitation of the commissioner of agriculture, constituted the majority of the speakers.

In the year 1897 the board of trustees of the agricultural college made an appropriation of $400 for holding farmers' institutes. C. A. Cary was designated by the trustees to have charge of this work. This appropriation was continued until 1901, when it was increased to $600, and still further increased to $800 in 1904. Members of the station and college staff constituted the force for holding institutes. In addition to regular institute work there has been held at Auburn since 1903 what is known as a round-up farmers' institute and summer school. Dr. Cary, director of institute work, has charge of this school. The lectures at this school are given partly by the staff of the experiment station and partly by lecturers from a distance. In February, 1911, the Legislature of Alabama passed an act known as a local-experiment law, making an appropriation to the Alabama Experiment Station for popular experimental work to be conducted in the various counties of the State with field crops, fertilizers, plant diseases, horticulture, insect pests, animal husbandry, poultry husbandry, farm machinery, and drainage. The same act contains an item of $5,000 appropriated annually to provide for agricultural-extension work in all parts of the State to be expended under the direction of the board of trustees of the Alabama Polytechnic Institute on the recommendation of the director of the experiment station.

The farmers' cooperative demonstration work in Alabama was organized in 1907 by Dr. S. A. Knapp, of the United States Department of Agriculture. There were employed in 1907 one State agent and five county agents. These agents were appointed as collaborators of the United States Department of Agriculture at $1 per year. The remainder of their salaries was paid entirely by the General Education Board of New York. In February, 1911, the Legislature of Alabama passed an act making an annual appropriation of $25,000 for demonstration work in cooperation with the United States Department of Agriculture. This act provides for a State board of agriculture, consisting of the commissioner of agriculture and industries, as chairman, the director of the experiment station, the professor of school agriculture in the Alabama Polytechnic Institute, and two practical successful farmers, to be selected by the three ex officio members of the board.

During the season of 1911 the following agents were employed: 1 State agent, in charge of men's work; 1 assistant State agent, in

charge of boys' club work; 1 assistant State agent, in charge of girls' club work; 3 district agents; 68 white county agents in men's work; 6 negro county agents; 3 women county agents, in charge of girls' club work.

On July 1, 1909, a memorandum of understanding between the United States Department of Agriculture and the Alabama Polytechnic Institute was made for the purpose of conducting in cooperation the boys' corn-club work. On June 1, 1911, this memorandum was amended and a new agreement was made for conducting in cooperation all boys' and girls' club work.

On May 22, 1914, the governor of Alabama gave the assent of the State to the provisions of the Smith-Lever Act, and designated the Alabama Polytechnic Institute, at Auburn, Ala., as the beneficiary. On July 1, 1914, representatives of the Alabama Polytechnic Institute signed the memorandum of understanding with the United States Department of Agriculture, providing for the establishment of the division of extension work in the college for the administration of all cooperative extension work in the State.

Organization and administration.—The extension division is organized as a separate department of the college. Cooperation is maintained between the college and the States Relations Service of the United States Department of Agriculture and with the State department of agriculture, as outlined in the general memorandum of understanding.

The director of the experiment station is also director of the extension work and has charge of all the extension activities in the State. He is assisted by a State agent in charge of all the men's county-agent work, and another assistant, who is superintendent of the junior extension work, which embraces all the boys' club work, the girls' canning and home-economics work, and the extension movable schools. In addition to the county agents' work, is that of a specialist along each of the following lines: Dairying, hog cholera, and agronomy.

The county agents' work is considered a fundamental part of the extension division and will be extended and strengthened as the funds increase and the demands require. The State board of agriculture is cooperating in the support of this division of the work with money appropriated for this special purpose by the State legislature. Plans for conducting the work are mapped out by the director, State agent, district and county agents. Specialists, also, are called in for assistance in planning any work in which they may be directly interested. Headquarters for the extension division are maintained at the Polytechnic Institute, at Auburn, and the majority of the force is housed in the agricultural building. There are

sufficient clerical assistants and equipment for conducting the work. All county agents are required to assist in the club work.

Publications.—In the year 1914–15 there were issued seven circulars for use in the extension service, prepared by members of the extension force and station and college staff. These publications were designed to supply the need of the farmers of the State for the kind of information they contained. There was also plate material prepared and sent out to the county and State papers. There is no complete mailing list, but one is being made up. For the present the experiment-station mailing list and the lists of farmers sent in by the agents are being used. The publications are also mailed out to farmers through the State upon request.

Finances.—The following is a summary of the resources for extension work for the year 1914–15:

Smith-Lever fund	$10,000.00
College appropriation	5,000.00
State board of agriculture	28,592.35
County appropriations	34,538.00
United States Department of Agriculture, farmers' cooperative demonstration work	48,000.00
United States Department of Agriculture, Bureau of Animal Industry	4,114.20
Total	130,244.55

The Smith-Lever funds were used in carrying out the following projects: Administration, publication, movable schools, boys' clubs, girls' clubs, dairying, agronomy, pig clubs, and departmental specialists.

A detailed financial statement showing the expenditures of these funds was submitted and approved.

By an act of the Alabama Legislature, adopted January 29, 1915, the Alabama Polytechnic Institute was permanently designated as the institution for administering the Smith-Lever funds. The trustees of the institution were authorized to receive the money appropriated to the State under this act. The same is to be paid out by the treasurer of the institution upon presentation of vouchers properly drawn, indorsed, and signed. These vouchers are made in duplicate, and one copy is kept with the treasurer and another with the director of extension.

Men county agents are paid partly from funds donated by the county or individuals in the county and partly from funds of the United States Department of Agriculture and State department of agriculture. The women county agents are paid partly from funds donated by the county and partly by funds from the United States Department of Agriculture.

County agents.—As the project for county agents was much the largest and the most important project of extension work in the State, it is treated first in order, although it did not receive any financial support from the $10,000 Smith-Lever appropriation to the State allotted for the fiscal year in question. The Smith-Lever fund was used for the creation of an administration division and for specialists, all of whom worked through the county-agent project.

The following agents were employed in connection with county farm-demonstration work during the season of 1914–15: One State agent in charge, with headquarters at the college at Auburn, 3 district agents, and 67 county agents. There were also 1 negro district agent and 7 negro county agents.

The county agent is the local representative of the entire system of extension work in the State. His duties are extremely varied. He supervises a large number of demonstrations in field crops, gives advice to farmers on a great variety of agricultural questions, and puts the farmers of the county in communication with the specialists at the college and the department at Washington. He organizes local associations, community clubs, boys' clubs, and live-stock associations and in every possible way assists farmers in organizing their work for better farming and more satisfactory living conditions.

The following were some of the results of demonstration work for the season of 1915: 3,580 cotton demonstrations, with total of 40,817 acres, made average yield of 1,077 pounds of seed cotton per acre; 4,850 corn demonstrations, with total 46,198 acres, made average yield of 36¼ bushels per acre; 2,362 oat demonstrations, with total 34,153 acres, made average yield of 32 bushels per acre; 223 demonstrations in wheat; 1,506 demonstrations in clover as a cover crop; 11,494 bushels of seed oats treated for smut; 39,630 acres of land terraced; 4,029 pure-bred live stock of all kinds brought into the State through work of the agents; 254 silos built under the agents' supervision; 205 farmers' community organizations formed; 1,623 schools visited; 791 field meetings held, with total attendance of 13,934; 64,932 farmers visited and given instructions; 6,927 farmers selected seed under agents' instruction; 1,693 farmers' meetings held with total attendance of 27,291.

In the year under consideration the demonstration agents effectively aided in the development of the live-stock industry of the State by bringing in better breeding stock, immunizing thousands of hogs against cholera, and by promoting tick eradication. Their local leadership in these directions had much to do with the public sentiment that caused the State legislature to provide, early in 1915, for tick eradication.

SMITH-LEVER PROJECTS.

Boys' clubs.—An agent, with headquarters at Auburn, is in charge of boys' corn clubs and boys' four-crop clubs, and gives his entire time to this work. During the year 1915 there were enrolled in the corn clubs 3,782 boys, who made an average yield of 55.7 bushels of corn per acre at an average cost of 37 cents per bushel. The State's average yield was 17 bushels per acre.

The four-crop club work is intended to develop competition in the production of four of the staple crops grown in a definite rotation. These four-crop clubs have been very useful in teaching the boys the relative value of the different staple crops grown. It was also a good demonstration for the boys in soil improvement. Four hundred and ninety-seven boys were enrolled in the four-crop clubs in 1915.

Pig clubs.—One specialist in charge of pig-club work, with headquarters at Auburn, was employed in cooperation with the Bureau of Animal Industry, United States Department of Agriculture.

The past year there was a total enrollment in these clubs of 2,633 boys. The principal part of the organization work in the counties was done by the county agents, who received instruction and assistance from the specialist in pig-club work.

Girls' clubs and home economics.—The girls' clubs and home economics work was organized in 19 counties during the season of 1914–15. In each of these counties a woman agent was employed. The work is supervised by one woman State agent, with headquarters at Auburn, and one woman assistant State agent, with headquarters at the Girls' Technical Institute at Montevallo, Ala. The Girls' Technical Institute cooperates with the college at Auburn, and the department is paying a part of the salary and traveling expenses of the assistant State agent in home-economics work.

The following are some of the results for the year 1915: Enrollment in canning clubs, 1,490; enrollment in girls' sewing clubs, 150; enrollment in girls' poultry clubs, 150; enrollment in home-demonstration clubs, 221.

Some of the financial results of the work were as follows: Value of vegetables sold fresh and used at home, $4,760; total value of canned products, $61,998; total cost of products, $18,268; total profit, $43,729.

Movable schools.—These consisted of farmers' meetings, held for two or three days at one place, in each of which instruction was given to men and women, boys and girls, on the subject of agriculture and home economics. The superintendent of the junior and

home-economics division had charge of the movable-school work. During the season of 1915, 19 schools were held, with a total attendance of 14,065; 12 schools were held for negroes, with a total attendance of 8,516.

Agronomy.—A specialist in agronomy was secured to give instruction on soils and field crops and to assist in holding movable schools and farmers' institutes.

Departmental specialists.—Provision was made for paying the traveling expenses of the members of the experiment-station staff, who were able to give but a small part of their time to extension work. Their activities were chiefly in addressing farmers' meetings.

Dairying.—A specialist in dairying was employed in cooperation with the United States Department of Agriculture. The dairy expert devoted his entire time to organization of cream routes, giving instruction in building of silos and dairy barns, and in educational propaganda work for building up the dairy industry of the State.

As a result of the dairy-specialist work, creameries were organized at Auburn and Selma, both of which are affording a market for a large amount of cream shipped in from many railroad points in the State.

OTHER EXTENSION WORK.

One hog-cholera specialist was employed in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, for extension work in hog cholera. His work was carried on in cooperation with the veterinarian of the college and the experiment station. This work was done mainly through the county agents in holding educational meetings and demonstrations to teach the methods of hog-cholera control. With the assistance of the agents 14,399 hogs were inoculated and instruction in sanitation carried to many farmers.

OUTLOOK.

The first year's operation of extension work in Alabama, as organized under the provisions of the Smith-Lever Act of Congress, gives reason for encouragement. Public opinion, while not yet thoroughly informed of the exact purposes and methods of extension work, has given cordial approval to each line of activity. Progress has been made in welding into a harmonious whole the various elements which had heretofore worked independently along various extension lines.

ARKANSAS.

Division of Extension Work, College of Agriculture, University of Arkansas, *Fayetteville.*

MARTIN NELSON, *Director.*

[J. H. Miller appointed director Aug. 11, 1915.]

History.—About the earliest historical interest in agriculture in Arkansas was created by a legislative act for the holding of agricultural and mechanical fairs in 1875. In 1889 there was an act passed creating the bureau of mines, manufactures, and agriculture, with a commissioner in charge. The office at first was appointive and later became elective. The commissioner's primary duty was regulatory. He was also expected to encourage and promote interest in other agricultural work, and especially to keep an agricultural exhibit in his office at the State House.

The Arkansas Industrial University was opened in 1872. This was the Agricultural and Mechanical College of the State, founded in accordance with the terms of the Morrill Act.

The first extension work of note was after the establishment of the experiment station under the Hatch Act. The first real extension work was in 1905, when W. G. Vincenheller, who was dean and director at the time, conducted farmers' institutes and meetings of one day each at a place. A small appropriation was made by the legislature for this purpose. No great progress was made in this line of work until 1913, when the legislature made an appropriation for its support for two years. The railroads gave transportation, local communities contributed money for the expenses, and the college of agriculture furnished men to carry on the work. There are no laws regulating institutes. The experiment station and college of agriculture have been conducting institutes in an irregular way since 1888.

In 1907 the State fair was held at Hot Springs. This assumed importance and holds a charter from the State for a fair association. In recent years there have been held a number of county fairs in different parts of the State.

There are agricultural societies, more or less local, among which may be included the State Horticultural Society, Sweet Potato Growers' Association, Cotton and Corn Improvement Association, Ozark Fruit Growers' Association, State Live Stock Association, and others. No doubt these have been beneficial in encouraging agriculture, especially in certain localities.

The farmers' cooperative demonstration work of the Bureau of Plant Industry, United States Department of Agriculture, was introduced into Arkansas in 1905 by the employment of one agent who

traveled in the southern part of the State and established a few demonstration farms along the railroads in 1906–7. Three agents were employed to cover a larger territory along the railroads in the boll-weevil section. County agents were employed for the first time in 1908. The number of agents was increased from year to year. The county agents' work was begun with the understanding that the county quorum courts or some local interest would supply a part of the funds to pay the agents' salaries. In 1912 there were 60 men agents and 8 canning-club agents. In 1914 there were 55 men county agents, 17 women agents, and 2 negro agents, in addition to the 6 supervising agents.

About 1909 the United States Department of Agriculture and the college entered into a joint agreement to employ an agent to supervise the club work of the State. At first this joint representative had headquarters at Fayetteville; later his headquarters were transferred to Little Rock, with the office of the State agent of the farmers' cooperative demonstration work.

In 1911 the girls' and women's work was organized with three agents. This work grew from year to year until in 1914 there were, besides the State agent in charge, 16 women county agents. Cooperative arrangements in club work remained unchanged until July 1, 1914, when the Smith-Lever Act became operative, and all extension work in Arkansas was combined with the University of Arkansas into one organization. The governor assented to the terms of the Smith-Lever Act on May 21, 1914, and the State legislature gave its assent on Mrach 27, 1915.

Organization and administration.—Under a general memorandum of understanding, dated July 16, 1914, between the college of agriculture and the University of Arkansas and the United States Department of Agriculture, the division of extension was created in the University of Arkansas. This organization, as constituted in 1914–15 in the State of Arkansas, had a director; State agent in charge of farmers' cooperative demonstration work; assistant State agent in charge of boys' club work; assistant State agent in charge of girls' and home-demonstration work; and specialists, including one in home-economics work, agronomy, pig club, hog cholera, tick eradication, dairying, horticulture, marketing; 3 district agents; 54 men county agents in farm demonstration; 20 women county agents in home-demonstration work; and 2 negro agents.

The extension work in Arkansas is divided into two main divisions—(1) the demonstration work in agriculture and home economics, through men and women county agents, with the necessary supervising force; (2) a corps of specialists, who work with the agents, conducting movable schools and carrying on special demonstrations in their particular lines.

The director is in charge of all the extension work in the State. The project leaders are responsible to him for the successful operation of the work. The supervising agents and the specialists confer with the heads of the departments of the college of agriculture and the experiment station in order that the subject matter used in the field work may be in harmony.

The official headquarters of the extension division is at the college of agriculture, and the director maintains his office there. The remainder of the force is located at the old statehouse at Little Rock. This arrangement is found advisable on account of being a more convenient point from which to work than the college of agriculture.

The director, the assistant director, supervising agents, and specialists are considered members of the faculty of the college of agriculture, and the director is a member of the administrative board of the university.

Publications.—During the year 1914–15, 28 extension publications were issued, aggregating 75 pages with a total number of 75,000 copies printed; 26 of these were leaflets, distributed principally to the newspapers of the State; one 16-page circular, Boys' Corn Club Work in the State; and one 32-page bulletin, Diversified Farming, were given wide distribution.

The material for these publications was prepared by members of the college of agriculture and the extension force. The experiment-station publications were used for distribution in special work.

During the year a mailing list was made up, embracing names of farmers, secured through county agents, bankers, and others.

Finances.—Cooperative extension work in agriculture and home economics in Arkansas in 1914–15 was supported by funds from the following sources:

Federal Smith-Lever funds	$10,000.00
College fund	4,666.98
State appropriation	6,236.65
County appropriation	43,212.67
Local communities	3,037.50
United States Department of Agriculture, farmers' cooperative demonstration work	41,574.89
United States Department of Agriculture, Bureau of Animal Industry	2,619.83
Total	111,348.52

The Smith-Lever funds were used in carrying out the following projects: Administration, publication, county agents', and boys' club work, girls' clubs and home-demonstration work, and specialists. A detailed financial report, showing the expenditures of the above amounts, was submitted and approved.

By an act of the Arkansas Legislature the college of agriculture of the University of Arkansas was authorized to accept from the

United States Government any sums coming to the State of Arkansas from the National Government under the terms of the Smith-Lever Agricultural Extension Act. The money is paid out through the treasurer upon the presentation of vouchers properly drawn, indorsed, and signed. All vouchers are made in triplicate and copies kept on file in the offices of the treasurer of the college, State auditor, and the director of extension work. The vouchers are numbered and also show to which project the money is allotted.

The plan for paying county agents in Arkansas requires that the counties or local people shall provide part of the salaries and the division of extension and United States Department of Agriculture a part. Usually $600 is the maximum limit of extension funds to one county with one agent. A few counties have contributed enough to secure two men agents and one woman agent.

SMITH-LEVER PROJECTS.

County agents.—The county agents' work is recognized as the fundamental part of the division of extension. All members of the division of extension are joint representatives of the college of agriculture and the United States Department of Agriculture. It is contemplated to extend the county-agent work to every county in the State as soon as finances will allow and there is a demand for it among the local people. The urgent demand for more thoroughly trained and better qualified agents and the willingness to increase the appropriations in the counties to pay such agents, show that the demonstration work is appreciated and established in the State. In counties where first-class agents have been employed there is little difficulty in raising funds to carry on this work.

All the county agents are expected to assist in club work, in farmers' meetings in their counties, in community or county fairs, and in organization work that may be beneficial to the farmers in handling and marketing their products. The leading lines of work to which the county agents' activities have been devoted, outside of the general crops, are farm meetings, combating the boll weevil, hog-cholera control, tick eradication, live-stock work, general diversification, club work, soil building, seed improvement, and drainage and terracing.

The following summary contains some of the things accomplished through the agents in 1915: Total number of demonstrations, 3,341; cooperators, 11,531; number of acres worked according to demonstration methods, 114,131; 67,788 acres in corn demonstrations, averaging 36.6 bushels per acre, or an increase over the State's average of 13.6 bushels; 4,576 cotton demonstrations, with an average of 1,048.7 pounds seed cotton per acre, which is an increase of 573.7 pounds

over the State's average yield under ordinary methods; 319 demonstrations in wheat, with total acreage of 3,999, averaging 18.9 bushels per acre, or an increase of more than 6 bushels per acre for the State's average yield. There was a greatly increased acreage in all small-grain crops, as well as hay and forage crops. The average yield for all hay demonstrations in the State was 2.4 tons per acre.

Through the influence of the agents 194 dipping vats were built; 166 silos erected; 29,054 hogs vaccinated; 5,159 head of stock treated for charbon; 125 farmers' clubs organized; 746 crop rotations planned; 543 new pastures started; 1,168 farms drained; 252 farms terraced; 5,724 home gardens started; 711 orchards, containing 74,042 trees, either pruned or sprayed under the direction of the agents; 11,561 pure-bred or high-grade live stock and 1,069 pure-bred hogs brought into demonstration territory; 27,076 field and farm meetings held, with a total attendance of 146,544.

Boys clubs.—Corn clubs were organized in 66 counties, with total enrollment of 2,175 boys, 583 of whom made complete reports. The average yield on all acres was 45.3 bushels, at an average cost of 35 cents per bushel.

Pig clubs were organized in 50 counties, with total enrollment of 853; 259 rendered complete reports. There were peanut clubs in 25 counties, with an enrollment of 525, 63 reporting.

One of the most interesting features connected with the club work in Arkansas in 1915 was a short course held at Little Rock for the county prize winners in the boys' and girls' clubs; 139 boys and 60 girls were in attendance at this school. Railroads furnished free transportation and the people of Little Rock entertained the boys and girls in their homes.

Girls' club and home-demonstration work.—The girls' canning club work in Arkansas is in a very flourishing condition. In 1915 there were 20 counties with agents. There was a total enrollment of 2,419 girls, 1,169 reporting. There were 986 meetings held among the women and girls, with a total attendance of 37,251. There were 108,092 jars, glasses, and cans of fruits and vegetables put up by these girls.

Poultry clubs were organized in 13 counties with a membership of 560, and some valuable work was started along this line. It is anticipated that it will become very popular among the girls and women as the work progresses.

This was the first year that the home-demonstration work was conducted in Arkansas; seven counties took it up in the spring, and good progress has been made along the usual lines in this important branch of the work. The instruction was largely confined to teaching the women canning and the importance of putting in their homes

more modern conveniences, such as fireless cookers, iceless refrigerators, fly traps, etc.

This work in 1915–16 will be greatly enlarged as 28 counties have made liberal appropriations for its support.

Specialists work.—In the absence of any definite report on the individual specialists projects, a quotation from the director's annual report is inserted, as follows:

> Eight hundred and twenty-five farm meetings were conducted with approximately 952 sessions, with a total attendance of 102,580. In addition to the regular specialists in the extension division, members of the faculty of the college of agriculture were called upon for assistance at various times. * * * That the farmers and business men are pleased with the work of the specialists, who conducted farmers' meetings, is evidenced by a much larger attendance at these meetings than heretofore. The attendance since July 1 aggregated 27,000. Another evidence is the greatly increased correspondence from farmers who write in frank friendliness for help on farm and stock problems. Several thousand farmers are reading with interest and profit the "Free Home Study Lessons," printed in 114 weekly papers of the State.

The only definite field work of the specialists was done through cooperation with the county agents. They assisted very materially along some lines of the live-stock work. The work of the specialist in horticulture was largely confined to the northwestern section of the State, which is the fruit-growing belt.

Negroes.—Two agents were employed during the year to work entirely among the negro farmers, one of them covering a territory comprising several counties, and the other confining his work to a single county. Many of the white agents enlisted negro demonstrators, and in other ways rendered very helpful service to the negro farmers of their counties. It is planned that this work will be extended in 1915–16.

The State agent and director are working out a system which it is hoped will be helpful to the negroes throughout the State, especially in the counties where there is a large negro population.

OUTLOOK.

The outlook for extension work in Arkansas is encouraging so far as the county agents' demonstrations with both men and women are concerned. Quorum courts and individuals have contributed liberally for the support of the work in 1916. This makes it possible to get well-qualified county agents for the contributing counties.

There are some difficult administrative problems in the State, due to local complications. In the main the work has been of good quality, and the results can be measured in the agricultural statistics of the State. A thorough harmonizing of the various forces within the State presents an interesting problem. With good leadership

and unity of purpose on a well-thought-out plan the work in Arkansas ought to proceed with continued success.

FLORIDA.

Division of Extension, College of Agriculture, University of Florida, *Gainesville.*

P. H. Rolfs, *Director.*

History.—The Florida Agricultural College was established in 1883. The experiment station was established in connection with the agricultural college in 1888. In the early days of the agricultural college the members of the college and station staff occasionally addressed farmers' meetings in different sections of the State.

In 1901 a legislative provision was made for defraying a portion of the expenses of the station and college staff for the purpose of holding farmers' institutes. The board of trustees of the college set aside $2,500 for this purpose. This really marked the beginning of organized institute work in the State. This allotment was continued until 1910. At this time the legislature provided in the appropriation to the college for the expenditure of $7,500 annually for farmers' institute purposes.

Prior to the organization of the agricultural college and the experiment station some efforts were being made to disseminate useful agricultural information among the people of the State. The one organization that had more influence than any other outside of the college and experiment station upon the history and development of agriculture in the State was the Florida Horticultural Society. This society was a federation of nurserymen, truckers, and fruit growers, which was organized in 1888. Twenty-eight annual meetings have been held in various parts of the State. The annual proceedings of this society have been published by private contributions. The membership has grown from 18, when organized in 1888, to 1,100 in 1915.

There is a State department of agriculture, which was created in 1889. The executive head of this department is elected by the people. The work of this department is largely for police and regulatory purposes. A few educational bulletins and leaflets have been published by the department.

The farmers' cooperative demonstration work was introduced into Florida in the fall of 1908 by Dr. S. A. Knapp, of the United States Department of Agriculture. During the season of 1909 two agents were employed. These agents were appointed as collaborators of the United States Department of Agriculture at $1 per year, the remainder of their salaries being paid by the General Education

Board of New York. In 1911 the legislature of Florida appropriated $5,000 to cooperate with the United States Department of Agriculture for employing county agents in farm-demonstration work.

On June 1, 1912, the following agents were employed in Florida: 1 State agent, 1 district supervising agent, 28 white county agents for men's work, 1 negro county agent, 1 woman agent in charge of the girls' club work, and 8 women county agents in girls' club work.

In the spring of 1911 the United States Department of Agriculture and the agricultural college of Florida entered into an agreement for the purpose of conducting in cooperation the boys' club work. A State agent, in charge of the boys' club work, was employed jointly by the department and the college, with headquarters at the University at Gainesville, Fla.

On October 25, 1913, cooperative arrangements were perfected with the United States Department of Agriculture and the University of Florida for conducting in cooperation all the extension activities in Florida.

On May 16, 1914, the governor of Florida gave his assent to the provisions of the Smith-Lever Act. On June 12, 1914, representatives of the University of Florida signed the memorandum of understanding with the United States Department of Agriculture, providing for the establishment of the division of extension work in the college for the administration of all cooperative extension work in the State.

Organization and administration.—The agricultural extension work is organized as a separate division of the college of agriculture. The work of this division is coordinated with the agricultural experiment station and with the teaching work of the agricultural college. The dean of the college of agriculture is also director of the experiment station and director of the extension division. The director of extension is assisted by the State agent, who has charge of all field activities of the extension division. In 1914–15 the State agent had as his assistants the agent for boys' club work and 2 district agents, who had the supervision of 35 county agents and 1 negro county agent, and another assistant State agent in charge of the girls' canning-club and home-economics work, with 1 district agent and 24 women county agents. The assistant in this work was employed in cooperation with the Woman's College at Tallahassee, Fla.

The county agent's work is considered a fundamental part of the extension division, and it is contemplated to put men and women in the counties as rapidly as the funds will allow and the demand for the work will justify. Plans for carrying on the extension work are outlined and agreed upon by the director, the State agent, and other supervising agents.

The director and the other supervising agents of the extension division have their headquarters at the University of Florida and are provided with suitable rooms, equipment, and clerical assistance. The assistant State agent in charge of the girls' club work and home economics maintains headquarters at the Woman's College at Tallahassee.

Publications.—In 1914–15 three publications were issued by the extension division, totaling about 30,000 copies. A weekly agricultural news service was maintained and distributed to the county and State newspapers. These news items were prepared by the members of the extension force, the agricultural college, and the experiment station. There is no complete mailing list, but these publications are distributed to the list of the experiment station and to the lists of farmers sent in by the county agents, and to the other people in the State upon request.

Finances.—The sources from which the extension funds were obtained in the State for the year 1914–15 were as follows:

Smith-Lever fund	$10,000.00
State appropriation	5,000.00
College appropriation	10,695.00
State fund for boys' and girls' club work	1,500.00
County and local funds	21,871.78
United States Department of Agriculture, farmers' cooperative demonstration work	26,347.55
United States Department of Agriculture, Bureau of Animal Industry	145.00
Total	75,559.33

The Smith-Lever funds were used for carrying out the following projects: Administration, publications, county agents, home economics, citrus diseases, hog cholera, and silo construction.

A detailed financial statement, showing the expenditures of these funds was submitted and approved. The statement shows a Smith-Lever balance of $75.

By an act of the Florida Legislature the college of agriculture of the University of Florida was named as the beneficiary of this act, and the board of control of the University of Florida was authorized to receive any funds coming to the State through the Smith-Lever Act. The same is to be paid out by the State treasurer upon presentation of vouchers, properly drawn, indorsed, and signed. These vouchers are made out in quadruplicate and copies kept for the offices of the State treasurer, chairman of the board of control, college accountant, and director of extension.

The county agents are paid partly from funds donated by the county or individuals in the county and partly from the funds of the extension division and the United States Department of Agricul-

ture. A maximum of $675 per county is furnished by the department and the extension division, the county putting up the remainder of the agent's salary.

SMITH-LEVER PROJECTS.

County agents.—The farm-demonstration work constitutes one of the main subdivisions of the extension work. Thirty-six counties accepted the work and provided for the payment from local funds for a part of the agents' salaries during the year. The work has proved so satisfactory that there is little likelihood that any of the counties will discontinue their support.

Under this cooperative arrangement with the county the agent becomes responsible for carrying on the demonstration work in the county to which he is assigned. The work is carried on in strict accordance with instructions from the college and the United States Department of Agriculture.

The county agents' work is supervised by one State agent, with headquarters at the college at Gainesville, and two district supervising agents, with headquarters at the college.

Through the timely advice and instruction of the county agents, a large number of farmers of the State have been enabled to increase materially their average production of all staple farm crops. In central, north, and west Florida county agents have laid particular stress on growing winter and summer legumes for soil building, more judicious use of commercial fertilizers, and the better care and handling of live stock. In the southern part of the State, where trucking and citrus growing are the main industries, the agents have devoted their attention largely to the better care and handling of citrus orchards and to combating citrus diseases and insects. In addition to this line of work, they have also given attention to the production of corn and hay, planting of legumes for soil building, and better care and breeding of live stock.

The following were some of the results of the work in 1915: Demonstrations in the following crops—corn 1,777, average yield per acre, 24.7 bushels, which was nearly double the average yield of corn in the State; cotton 411, average yield per acre of seed cotton, 656 pounds, which was more than double the yield of cotton produced under ordinary methods; tobacco 4, average yield per acre, 1,270 pounds; oats 513, average yield per acre, 25.06 bushels; alfalfa 18, average yield per acre, 23.87 tons; Sudan grass 21, average yield per acre, 21.35 tons; crimson clover 11; rye 27, estimated value per acre, $15.45; sorghum grown for hay 23, average yield per acre, 3.7 tons; cowpeas 67, average yield per acre, 10.5 bushels; velvet beans 109, average yield per acre of shelled beans, 17.6 bushels; peanuts 73, average yield per acre, 38.6 bushels; soy beans 12, average yield per

acre of cured hay, 2.19 tons; sweet potatoes 139, average yield per acre, 122.6 bushels; Irish potatoes 34, average yield per acre, 89 bushels.

The following pure-bred live stock was brought into the State in 1915, under the agents' instructions: Four pure-bred stallions, 1 jack, 26 dairy cows, 26 beef bulls, 61 beef cows, and 459 pure-bred hogs. Two thousand one hundred and eighty-nine cattle were treated for blackleg, charbon, and other diseases by the agents. The county agents also held a large number of educational meetings to give instructions in the best methods to pursue in hog-cholera control. Four thousand five hundred and seventy-three farmers were advised in regard to the proper use of fertilizers; 51 silos were constructed under agents' supervision; 21 dipping vats were built; 160 farm buildings were planned under agents' direction; 25 home waterworks were installed; 2 home-lighting systems were installed; 162 home grounds were improved; 487 homes were screened against flies; 17,200 farmers were furnished plans for systematic crop rotations.

Boys' clubs.—The boys' club work consisted of demonstration work with boys, carried on entirely with the raising of larger and more economical crops of corn. The work was done through the county agents, working under the instructions and directions of the State agent. Much interest was manifested by the boys in the competition of corn raising.

The organization of the boys' corn clubs was carried on directly in cooperation with the county superintendents of education, the teachers of the rural schools, and the county demonstration agents. One thousand three hundred and twenty-five boys were enrolled, producing an average yield of 37.5 bushels of corn per acre at an average cost of 48 cents per bushel.

Girls' club and home economics.—A State agent and an assistant State agent, with headquarters at the Florida State College for Women, Tallahassee, Fla., are employed to supervise the extension work in girls' club and home economics. All agents employed in this work were paid jointly by the United States Department of Agriculture and the county boards of education. Women county agents were employed in 1914–15 in 27 counties; 1,838 girls were enrolled in the canning clubs; $9,525 worth of canned products were sold by the girls' clubs.

Home-demonstration work with the women has been started. There were organized in the State last year three or four clubs for women in each county where an agent was employed. The lines of work followed by the home clubs are the demonstration of best methods of canning the fruits and vegetables raised on the farm, the proper handling of poultry, and the study of household conveniences.

Three hundred fireless cookers and 50 iceless refrigerators were made by the home-demonstration clubs in 1915.

Animal husbandry.—The professor of animal husbandry in the college did some extension work during the summer months. It was devoted mainly to giving instruction on silo building, the preparation and handling of silage, the selecting of breeding stock, and in assisting county agents in holding meetings for giving instruction in the care and handling of live stock.

Hog cholera.—One specialist was employed to carry on educational work among farmers for hog-cholera control. There were 76 educational meetings held by the specialist, with a total attendance of 5,252; number of demonstrations given of preventive treatment, where serum alone was used, 31, with total attendance at demonstrations of 839; 698 farmers and hog raisers personally interviewed. The county demonstration agents, under the instruction of the specialist, inoculated 9,000 hogs against cholera.

Citrus diseases.—This project was to cover the traveling expenses of specialists in the college to visit the groves to give advice on control of citrus diseases.

OUTLOOK.

The work is meeting with the hearty approval of the farmers of the State. It has been an easy matter to secure county aid for employing men agents for farm-demonstration work and women agents for the girls' canning club and the home-economics work.

The counties are increasing their appropriations each year and insist on securing the best trained men and women to carry on the work. The work has received the hearty cooperation of the State department of agriculture, the State department of education, farmers' organizations, and business men during the past year. The outlook for the work is very encouraging.

GEORGIA.

Department of Extension, Georgia State College of Agriculture, *Athens.*

A. M. Soule, *Director.*

[J. Phil Campbell appointed director July 1, 1915.]

History.—Experimental work in agriculture was begun in Georgia under the auspices of the University of Georgia at Athens in 1882. In 1888 the Georgia Experiment Station was organized by the board of trustees of the University of Georgia as a part of the Georgia State College of Agriculture. The extension work of the station

and the State college of agriculture for many years consisted in sending out press and experiment-station bulletins, and occasional addresses were made at farmers' meetings by members of the station staff and the faculty of the college of agriculture.

The farmers' institute movement proper began in Georgia in the year 1899, at which time the Atlanta Semiweekly Journal appropriated $750 to hold a series of farmers' institutes under the direction of its agricultural editor. Fifty institutes were held that year. This appropriation was not continued, and the work was suspended until 1903, when it was taken up by the University of Georgia. In that year the trustees of the university made an appropriation of $1,000 for farmers' institute purposes. Mr. Harvie Jordan, of Monticello, was selected as first institute director and was instructed to hold one farmers' institute in each senatorial district of the State. Forty-four institutes were held. The faculty of the agricultural college and the staff of the experiment station took part in these institutes. During the spring of 1908 an agricultural train carrying lecturers and exhibits from the college was run, and every county in the State having a railroad was visited. In 1909 the legislature appropriated to the State college of agriculture $10,000 for extension work. With this fund extension work was begun in horticulture, agronomy, dairy-husbandry, and rural-school extension work, including boys' and girls' clubs. The dairy-extension work and the boys' and girls' club work were in cooperation with the United States Department of Agriculture.

In 1911 the legislature increased the appropriation for extension work to the amount of $40,000. Beginning January 1, 1912, the following extension activities were inaugurated: Soil survey, $8,500; agronomy, $8,500; poultry, $3,000; horticulture, $2,500; boys' and girls' club work, $15,000; and dairy work, $2,500.

The farmers' cooperative demonstration work of the United States Department of Agriculture was introduced into Georgia by Dr. S. A. Knapp in the fall of 1907. The work the first year consisted of 1 State agent and 6 county agents. The agents were employed as collaborators of the United States Department of Agriculture at $1 per year, the remainder of their salaries being paid entirely by the General Education Board of New York. In 1912 the work had grown until there were employed 86 agents, as follows: 1 State agent, 3 district supervising agents, 60 county agents for men's work, 7 agents supervising boys' club work, and 15 agents supervising girls' club work. On November 3, 1909, an agreement was made between the Georgia State College of Agriculture and the United States Department of Agriculture, and an agent was jointly employed for supervising boys' club work. On December 1, 1912, a new agreement was made between the United States Department of

Agriculture and the State college of agriculture for conducting in cooperation the farm-demonstration work and boys' and girls' club work, and a State agent was jointly selected to have charge of the work.

On May 20, 1914, the governor of Georgia gave the assent of the State to the provisions of the Smith-Lever Act and designated the State College of Agriculture, Athens, Ga., as the beneficiary. On June 6, 1914, the representatives of the State college of agriculture signed the memorandum of understanding with the United States Department of Agriculture providing for the establishment of the division of extension work in the college for the administration of all cooperative extension work in the State.

Organization and administration.—The extension division is organized as a separate department of the college, ranking equally with every other department. Cooperation is maintained between the college and the States Relations Service, United States Department of Agriculture, in accordance with the general memorandum of understanding. The president of the agricultural college was acting director of extension work during the year 1914–15, and had full charge of all extension activities, but left the detail of the field management to the State agent of farm-demonstration work and to an executive secretary. The executive secretary had charge of field meetings, farmers' institutes, movable schools, and educational exhibits at State and county fairs. The State agent supervised the work of the county agents in agriculture, home economics, and boys' and girls' club work. The work of the specialists is planned in cooperation with the heads of the different departments of the college, subject to the approval of the acting director of extension. On July 1, 1915, the State agent was appointed director, and in the future will have entire charge of the extension work.

The county agents' work is considered a fundamental part of the extension division. Plans for conducting the work are outlined and agreed upon between the director and other supervising agents. The specialists are also consulted about work along their lines. The specialists and all the other leaders in extension work are responsible to the director and State agent. The county agents are required to assist in club work. The subject matter used by the extension workers is submitted to the members of the faculty under which the subject would come for approval as to its correctness. The county agents' work will be extended as rapidly as funds become available and the interest in the county demands. The supervising force of the extension division has headquarters in the agricultural building at the agricultural college, where they are furnished with sufficient room, equipment, and clerical force. An agricultural editor is employed, who assembles and prepares material for publication.

Publications.—During the year 1914–15 the extension department published 20 circulars and bulletins, totaling 128,000 copies and containing 2,000,000 pages. Plate material was also furnished the county and State newspapers monthly. These publications were prepared by members of the extension division and the college faculty and were designed to meet the demand among the farmers of the State for the information contained. The distribution was made through a regular list, which is being added to continually, and also through the county agents as they travel about over their territory.

Finances.—The total resources for extension work in 1914–15 were as follows:

Smith-Lever	$10,000.00
State appropriation	40,000.00
County and local community appropriations	46,000.00
United States Department of Agriculture, farmers' cooperative demonstration work	50,000.00
United States Department of Agriculture, Bureau of Animal Industry	9,451.49
Total	155,451.49

The Smith-Lever funds were used in carrying out the following projects: Administration, printing and distribution, home economics, movable schools and farmers' courses, boys' club work, girls' club work, and animal husbandry.

A detailed financial statement showing the expenditures of these funds was submitted and approved. This statement showed a Smith-Lever balance of $72.86.

By an act of the General Assembly of Georgia the acceptance of the terms of the Smith-Lever Act by the governor was approved, and the board of trustees of the University of Georgia was designated to receive the money coming to the State through this act and to pay it out through the university treasurer upon presentation of vouchers which are properly drawn, indorsed, and signed. Vouchers are made in duplicates and copies kept at the office of the treasurer of the university and the office of the president of the agricultural college.

County agents, both men and women, are paid partly from funds donated by the county or individuals in the county and partly from funds from the extension division and the United States Department of Agriculture.

County agents.—As the project for county agents was much the largest and the most important project of extension work in the State, it is treated first in order, although it did not receive any financial support from the $10,000 Smith-Lever appropriation to the State allotted for the fiscal year in question. The Smith-Lever fund was used for the creation of an administration division and for specialists, all of whom worked through the county-agent project.

The following agents were employed in connection with the county agents' work during the season of 1914–15: One State agent in charge, 1 assistant State agent for boys' club work, 4 district supervising agents, 64 county agents (white), 2 county agents (colored).

The county agents' work is carried on in cooperation with the United States Department of Agriculture. The salaries of the supervising agents are paid partly by funds appropriated by Congress to the United States Department of Agriculture and partly by the State college of agriculture. The counties in which agents are employed are required to pay a part of the salaries of the county agents.

The following were some of the results achieved in demonstration work in 1915: Four hundred and eighty-nine pure-bred beef cattle were brought into the State; 205 dipping vats built; 2,760 poultry-demonstration farms established; 100,000 head of cattle treated for blackleg and other diseases; 11,800 farmers advised regarding the proper use of fertilizers; 96 silos built; 7,584 tons of lime used by 1,496 farmers under instructions from agents; 108 farmers' clubs organized, with a membership of 2,092; 2,800 acres of land surveyed for drainage and 2 canals being built; 31,600 acres of land surveyed by agents for terracing, for 2,475 farmers; 17,905 acres of land cleared of stumps by dynamiting, pulling, and digging; 5,720 home gardens planted; 250 plans furnished for farm buildings; 152 water systems installed; 71 home lighting systems, 24 telephone systems, and 928 homes screened against flies and mosquitoes. There were 80,240 farmers visited by agents; 233,919 miles traveled; 47,168 calls on agents in office and home; 750 field meetings held; 1,036 public meetings, with total attendance of 108,100; 38,982 letters written; 1,128 articles prepared; 55,980 circular letters sent out; 203,786 bulletins distributed; 2,900 schools visited; 148 miscellaneous meetings held; attendance of 3,812 at field meetings; 8 other extension schools assisted, with a total attendance of 1,550; 24,563 demonstrations conducted with following crops—corn, 5,032, with 34,634 acres, averaging 36 bushels, State yield averaging 15 bushels; cotton, 1,478 demonstrations with 9,540 acres, averaging 1,350 pounds seed cotton per acre, State yield averaging 579; oats, 1,466 demonstrations with 7,683 acres, averaging 40 bushels, State yield averaging 19½; wheat, 570 demonstrations with 2,237 acres, averaging 16 bushels, State yield averaging 11; hay and cover-crop demonstrations, 2,185 with 19,498 acres, averaging 2½ tons, State yield averaging 1⅕ tons; potatoes, 643 demonstrations with 1,929 acres, average yield 179 bushels, State yield averaging 83.

SMITH-LEVER PROJECTS.

Boys' agricultural clubs.—During the past season 8,685 boys were enrolled in the corn clubs; 2,073 boys completed the work and made a report, showing an average yield of 45.4 bushels of corn per acre,

while the average for the State was only 15 bushels per acre. One thousand six hundred and ten prizes, representing a value of $10,340, were awarded to the club members. Nine hundred and twenty-nine boys enrolled in what was known as the Four-crop Club. Each member of the Four-crop Club is required to have at least three acres of land and to cultivate the following crops in rotation: Corn, cotton, oats, and cowpeas. These four-crop clubs have been very useful in teaching the boys the relative value of the different crops grown. The average yield per acre made by the four-crop boys was 1,626 pounds seed cotton per acre, or a net profit of $28.06. The average yield of corn per acre was 55 bushels with an average net profit of $36.63. The average yield of oats per acre was 38 bushels, with an average net profit of $21.02. The average yield of hay per acre was 3,197 pounds of cured hay, with an average net profit per acre of $24.53.

The corn-club work has been mainly responsible for establishing a great many county fairs during the past few years, and the exhibits now being made by the boys at the county and State fairs are attracting a great deal of attention from farmers and business men of the State.

Girls' clubs and home economics.—In 1915 this work was organized in 48 counties, each supervised by a woman agent. The work was supervised by two assistant State agents with headquarters at the State College of Agriculture, Athens, Ga. Four thousand six hundred girls were enrolled in the canning club, 400 in the poultry club, and 200 in the home-demonstration club. As a rule the girls in the canning clubs cultivate and can the products from a one-tenth-acre garden. In this way they not only do healthful work in the open air, but they save thousands of dollars' worth of surplus products grown on the farm which are canned and put in shape for market. The garden and canning-club program was planned and carried out as a campaign to change the diet and improve the health of the people. Incidentally it is teaching the girls lessons of thrift and economy.

The total value of all garden products in 1915 was $29,588.49; total number of canned goods put up was 332,240.

The plan of the home-demonstration work contemplates the study and demonstration of the best methods of cooking, home decoration, dairy, poultry, and garden management. A very large number of labor-saving devices and conveniences have been made at the suggestion of the county agents. Among the useful items of home conveniences made by the members of the home-demonstration clubs are fireless cookers, iceless refrigerators, butter mixers, butter molds, and fly traps.

Extension schools.—Five extension schools, of one week each, were held in February and March at the following places: Ashburn, Dublin, Sparta, Macon, and Euharlee. In accordance with the instructions of the board of trustees a registration fee of $1 is charged, and a minimum of 30 students is required before a movable school is held. Five thousand three hundred and thirty-two received more or less formal instruction in the movable schools in 1914–15. A carload of cattle was carried to each place where a movable school was held for use in live-stock instruction, and a car of scientific apparatus and exhibit material for illustrating the course in soils, farm crops, horticulture, and animal and poultry husbandry.

Live stock.—Three live-stock specialists were employed in live-stock extension work in cooperation with the United States Department of Agriculture. The principal lines of work of the live-stock specialists consisted of conducting demonstrations in feeding of beef cattle, organizing live-stock associations, assisting in purchasing better breeding animals, and giving general information on the improvement and development of the live-stock industry. These specialists worked through the county agents. In 1914–15 they were instrumental in having 532 pure-bred horses, mares, and jacks shipped into the State, 129 pure-bred bulls, 360 cows. Also 1,816 head of cattle were fed during the winter under the joint direction of the specialists and county agents.

OTHER EXTENSION WORK.

Pig clubs.—One pig-club specialist was employed in cooperation with the United States Department of Agriculture to conduct club work among the boys; 1,500 members of the boys' pig clubs were enrolled during the season of 1914–15. The work was largely carried on by the county agents, under the plans and instructions furnished by the specialist in charge of the work.

Hog cholera.—One field specialist was employed during the season of 1914–15 for giving instruction in the control of hog cholera. This work was in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. The entire time of the hog-cholera specialist was spent in cooperation with the county agents in holding educational meetings for the farmers and giving demonstrations in the best methods to be employed in the control of hog cholera. Forty-nine thousand four hundred and ninety-two hogs were treated for cholera, and many farmers instructed as to sanitary methods for aiding in the control of the disease.

Agronomy.—Two specialists were employed for extension work in agronomy. Demonstration plats were located in various sections of the State for the purpose of determining the value of different kinds

of fertilizers and varieties of seeds on different types of soils. Agronomy-extension work is closely identified with the soil surveys, and each plat of soil is carefully analyzed for the purpose of securing accurate data of the soil types.

Dairying.—Two specialists were employed in the dairy-extension work in cooperation with the United States Department of Agriculture. They were instrumental in establishing 2 cooperative creameries and improving 33 dairy farms. Ninety-six silos were built under their direction. The work was carried on in cooperation with the county demonstration agents. A large number of demonstrations were conducted in butter making in schoolhouses and at farmers' field meetings. These demonstrations were made in cooperation with the county agents in girls' club work and home economics. Thirty-three dairies and two creameries were established.

Horticulture.—One specialist was employed in horticulture, who conducted demonstrations in trucking, home orchards, and gardens. This work was carried on in cooperation with both the county agents in demonstration work and the county agents in the girls' canning-club and home-economics work. The greater part of the specialist's time was spent in giving instructions to county agents, and in connection with the agents 2,460 orchard demonstrations were held for the purpose of giving instructions in spraying, pruning, and culture of orchards. Fifty-eight thousand nine hundred and twenty-five trees were represented in this orchard work.

OUTLOOK.

The extension work in Georgia is now well organized and is meeting with the hearty approval and indorsement of the people of the State. The work is growing rapidly, and the outlook for the future is very encouraging. The district agricultural schools are cooperating with the extension division in all extension work. It is planned to make each of such schools a center for extension work in its territory by locating at them the district agents. The cooperation of all the agencies for agricultural education in the State is thus assured. The number of county agents and county home-demonstration agents will be rapidly increased as funds become available.

KENTUCKY.

Division of Agricultural Extension, College of Agriculture, the State University, *Lexington.*

FRED MUTCHLER, *Director.*

History.—The first organized effort along agricultural-extension lines seems to have been made at a cattle fair in 1817, when the first State agricultural society was organized. It seems that this society ceased its existence after two years.

The second society was organized in 1838. Its constitution provided, among other things, for "the dissemination of agricultural information over the whole State." From the impulse of this organization records show that 27 county and district agricultural societies were formed prior to 1841, when the society dissolved.

The third society was organized and incorporated in 1856. The legislature appropriated $5,000 per annum for two years for its support. In 1858 it failed to continue the appropriation, and the society went out of existence. In the meantime a great many county agricultural associations had been formed.

In 1876 the Bureau of Agriculture, Horticulture, and Statistics was formed and, among other things, conducted farmers' institutes. In 1887 the commissioner in charge reported, "Farmers' institutes are on the increase." Increased appropriations enabled more work to be done along this line.

The legislature of 1912 made an appropriation of $5,000 to this bureau, now called the department of agriculture, for boys' and girls' club work. This fund was used cooperatively with the extension divisions of the college of agriculture.

Beginning July 1, 1910, an extension department was organized in the experiment station and a part of its funds set aside for this work. Specialists in agronomy, horticulture, and dairying were employed. Extension publications were issued, a live-stock exchange started, alfalfa clubs organized, and a foundation laid for greater accomplishments in the future.

In an act of March, 1912, agricultural extension was specifically named, but no definite amount of money indicated for that work.

In July, 1912, the first county agent was appointed, the college of agriculture, through its extension division, and the Office of Farm Management, Bureau of Plant Industry, United States Department of Agriculture, cooperating. By July, 1913, seven more county agents were employed. During the last half of the fiscal year 1912–13 this work was gradually taken over from the Office of Farm Management to that of the Farmers' Cooperative Demonstration Work. Beginning with the next fiscal year the formal change was made.

Funds from the General Education Board of New York were used through the latter office for the adult work referred to and for the organization of boys' clubs, the leader of the same having headquarters at the Western Kentucky Normal School. Some work had been done in boys' clubs in 1911 with funds from the State department of agriculture. This work was carried on in connection with the normal school until July 1, 1913, when the leader was appointed head of the extension division at the agricultural college and the administration removed to that institution. At that time the county

agents' work, the boys' club work, and the girls' club work were combined under the one head just mentioned.

During the fiscal year 1913–14, $17,044.65 from the General Education Board was used for adult, boys', and girls' club work. This last activity was started October 1, 1913.

On July 1, 1914, the funds of the General Education Board were entirely replaced by those of the United States Department of Agriculture, and its connection with the extension work in this State terminated.

Organization and administration.—The assent of the governor to the terms of the Smith-Lever Act was given prior to June 30, 1914. The legislature has not met since the passage of this act. Under a signed agreement between the president of the State university and the Secretary of Agriculture, dated June 27, 1914, all extension activities of the college of agriculture and the United States Department of Agriculture were coordinated and a separate extension division organized, having charge of all extension activities within the State, except farmers' institutes. The superintendent of the division was made responsible to the dean of the college of agriculture, who was also director of the experiment station.

Publications.—The extension publications deal with subjects of immediate interest to farmers and their families, and are of three types: Circulars, press bulletins, and depot posters. Twelve circulars of 4 to 36 pages, 26 press bulletins of 1 page each, and 12 depot posters, one for each month, were printed during the year 1914–15.

No mailing list was kept at first, but the publications of the division were sent to men and women agents for distribution, or mailed directly to farmers upon request. Toward the end of the year a mailing list was prepared.

Members of the college and station staff prepared or assisted in the preparation of material for publication.

Finances.—The amount and sources of funds used for extension work in agriculture and home economics during the fiscal year 1914–15 were as follows:

Federal Smith-Lever fund	$9,874.63
Experiment station or college	5,854.02
County and local appropriations	31,928.12
United States Department of Agriculture, farmers' cooperative demonstration work	36,861.10
United States Department of Agriculture, Bureau of Animal Industry	3,015.98
Total	87,533.85

During the fiscal year 1914–15, Federal Smith-Lever funds were spent through the following projects: Administration; printing and distribution of publications; home economics; girls' canning clubs;

movable schools; dairying; boys' clubs; and travel of experts in horticulture, agronomy, and rural organization. These funds are sent direct to the State treasurer, who in turn sends them to the treasurer of the State university, upon the requisition of the president. They are then deposited in bank to a separate account, having a separate check book and check register.

A detailed statement of the expenditure of these funds was submitted and approved, this statement showing a Smith-Lever balance of $125.37.

Cooperation exists with the State department of agriculture, whereby the $5,000 appropriated by the legislature for boys' and girls' club work is paid by that department to the agents engaged in this work. The direction of these agents is vested in the extension division of the college.

The Eastern and Western Normal Schools of the State are cooperating with the extension division by furnishing offices for two district agents and the State agent; also some stenographic assistance. A portion of the salary of these district agents is paid by the normal schools.

The plan of organization is to have a department of extension work, with a superintendent in charge of all agriculture and home-economics activities within the State, except that of farmers' institutes, which is by law under the direction of the commissioner of agriculture.

The plan of having a man and woman agent in each county in the State as soon as possible is considered of primary importance and as a proper basis from which to work. These are joint employees and representatives of the college and the United States Department of Agriculture.

Specialists are employed, with headquarters at the college. They devote their time to work through the county agents and otherwise in carrying on instruction and demonstrations with farmers. All specialists are selected by the superintendent of extension work, after consulting with the heads of the various departments, except those working in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, who are selected by that bureau and approved by the superintendent of extension work.

The extension division looks to the experiment station and the agricultural college as authority on matters pertaining to the subject matter in agriculture and home economics to be taught throughout the State. Members of the staff of both the college and station are frequently used for special lectures in farmers' meetings, movable schools, etc.; also in planning the work to be carried on in various projects.

County agents.—As the project for county agents was much the largest and the most important project of extension work in the State, it is treated first in order, although it did not receive any financial support from the $10,000 Smith-Lever appropriation to the State allotted for the fiscal year in question. The Smith-Lever fund was used for the creation of an administration division and for specialists, all of whom worked through the county-agent project.

The superintendent of extension work was also State agent in charge of this project until May 1, 1915, when a State agent was appointed to have charge of the work of county agents. The county agent is considered the leader of all extension activities in his county. Under this project he is directly responsible to his district agent, who has charge of 15 to 20 other county agents. The district agent reports directly to the State agent. During 1914–15 one district agent was employed the entire year, located at the Western Kentucky Normal School. Another was located at the Eastern Kentucky Normal School after October 1, 1914. At the beginning of the year 20 agents were employed. This was increased to 37 agents by the end of the year.

County fiscal courts, business organizations, and individuals contributed to the support of these agents, paying one-half of their salary. The other half is paid by direct appropriation from the United States Department of Agriculture to this work and from Federal and State Smith-Lever funds. Their work is to give instruction to farmers on better methods of agriculture, including farm practices and management, the raising of crops, production of live stock, etc., and to carry out, under their supervision, practical demonstrations illustrating the same. A brief summary of a part of their work for the year ending December 31, 1915, is here given:

Nine thousand six hundred and three farmers used better methods in growing corn. One thousand nine hundred and sixty-one of these, with 24,831 acres, secured an average yield of 51 bushels, or 30.5 per cent above that obtained by ordinary methods. Two thousand one hundred and forty-eight acres of oats grown by improved methods by 286 farmers made an average yield of 38.5 bushels, or 41.7 per cent over those grown the usual way. On 919 farms 16,497 acres of wheat grown in cooperation with the county agents yielded an average of 16.7 bushels, or an increase of 51.9 per cent. One thousand eight hundred and sixty-eight farmers grew 14,862 acres of alfalfa, red clover, timothy, and other hay crops. Reports received show an average increase of 50 per cent in the yield of hay by the use of better methods. One thousand one hundred and forty-seven farmers grew 7,586 acres of cowpeas and soy beans, most of them for the first time. Forty-seven thousand eight hundred and eighty-eight acres of rye, crimson clover, etc., were sown for cover

crops. Two hundred and ninety-seven demonstration orchards, containing 40,730 trees, were pruned, sprayed, etc. In improving the live stock of the State, 25 pure-blood stallions, mares, and jacks were brought in; 139 bulls and 278 cows or heifers; 287 hogs and 258 sheep. Six hundred and six cows were tested to determine the profitable producers. Four thousand four hundred and eighty-nine cattle, 9,391 hogs, and 3,402 sheep were fed according to methods advocated. Five dipping vats were built in the State; and 62,677 cattle, hogs, sheep, and horses were treated for diseases and insect pests. Poultry demonstrations were conducted on 66 farms, with 8,215 fowls; 1,506 fertilizer demonstrations were carried on; fertilizer was bought cooperatively to the amount of $115,968.46, at a saving of $37,431.83 to the farmers. Two thousand four hundred and thirty-four farmers were induced to take better care of farm manures; 889 farmers were induced to use lime, aggregating 35,740 tons; 222 silos were built in the State; 1,169 farm buildings were erected or improved, 555 home gardens better cared for, 817 homes screened, and 756 farm and home sanitary conditions improved; 109 farmers' clubs were organized, with a total membership of 5,993.

SMITH-LEVER PROJECTS.

Home ecomonics, including girls' clubs.—Work under this project was started October 1, 1914, supported by the State and Federal Departments of Agriculture, and with a State agent, reporting directly to the superintendent of extension, in charge. Under her were 24 women agents, employed four to six months each during the latter half of the fiscal year, in 25 counties. Their work consists in the organization of girls' and women's clubs, and the instruction of the members of such clubs in the raising of gardens, the canning of fruits and vegetables, the raising of poultry, and in home economics. Three women specialists were employed for a part of the time, to assist in home-economics extension work. A partial report of results for the year ending December 31, 1915, is given below:

Twelve hundred and seventy-two girls and 600 women were enrolled in these clubs; 452 caps and aprons were made; 48,898 No. 3 cans of tomatoes and 36,558 quarts of other vegetables and fruit were put up, at a net profit of $15,000, or an average net profit to the club members of $35.17.

Boys' clubs.—Boys' club work is a part of the county agents' regular duties, and practically all boys' club activities are under their supervision. During the latter half of the year an assistant State agent, reporting to the State agent in charge of county agents, was employed in charge of all boys' clubs.

Corn clubs: In boys' corn clubs 1,246 members were enrolled. The average yield of those reporting was 67.8 bushels; the value of prizes offered, $1,177.

Pig clubs: During the year an agent in charge of boys' pig clubs was employed jointly by the extension division and the Bureau of Animal Industry, United States Department of Agriculture. Work under this project started too late in the year for any definite results to be reported; however, 313 boys were enrolled and $227 in prizes given.

Poultry clubs: Work of the extension division under this project was in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture, and was organized and supervised during the year by an agent jointly employed. It had for its purpose the formation of poultry clubs for women, boys, girls, and farmers, and the instruction of such clubs in poultry husbandry. Practically all the work was done with the boys and girls under the supervision of the women agents. A few men county agents were allowed to work along this line. Thirty-five clubs were organized, with a membership of 498 boys and girls.

Specialists.—The live-stock project is in charge of a specialist, who also acts as assistant to the superintendent of extension. This work is carried on through the county agents and otherwise, and consists in giving special instruction and conducting definite demonstrations with farmers, under the direct supervision of the county agent. Besides demonstrations in the feeding of beef cattle and the grazing of hogs, this specialist has charge of the live-stock exchange of the extension division, assists in the organization of pure-bred sires' clubs and other live-stock organizations.

The results accomplished under this and the following specialist projects are incorporated with those of county agents' work.

One specialist was engaged in horticultural extension. The purpose of the project was to teach and demonstrate principles of horticulture among farmers of the State. In counties having agents all work was conducted through them and assistance rendered at such times as necessary. The principal lines of work engaged in by this specialist were spraying, pruning, fertilizer, home-garden, packing, and orchard-planting demonstrations.

The work of the specialist in charge of dairy extension, covering a part of the year, was supported cooperatively by the Dairy Division of the Bureau of Animal Industry, United States Department of Agriculture, and the extension division of the college, the object being to give instruction to farmers, through county agents and otherwise, in the management of dairy herds, construction of silos, barns, etc. A part of the time of this specialist was taken up in preparing dairy exhibits for fairs throughout the State.

The specialist in agronomy and soil fertility worked only a few months during the year; however, during that time a number of alfalfa clubs were formed.

The extension work in rural organizations was in charge of a specialist employed a part of his time. The plan followed was that of teaching and demonstrating principles of rural organization among farmers of the State, largely in counties having agents.

Movable schools.—Under this project arrangements were made for the extension specialists and other members of the agricultural college force to hold farmers' meetings in cooperation with the State department of agriculture. About 75 such meetings were held during the past year.

OTHER EXTENSION WORK.

The only other institution in the State doing extension work is the State department of agriculture, which is conducting farmers' institutes and movable schools, furnishing silo forms, and money for canning, poultry, corn, and pig-club work, as provided by law. During the year it sent representatives of the corn and pig clubs from each county to the State fair, paying all expenses.

OUTLOOK.

Kentucky is showing up well in the county-agent work. The organization is proceeding slowly but building on a firm foundation. Farmers of the State generally are giving strong moral and financial support to the work. The extension division is gradually drawing together the agricultural forces of the State. One of the district agents is located at each of the two State normal schools, and there is active cooperation with the State department of agriculture. Under the proper administrative leadership and the necessary support from all institutions and other agricultural forces of the State the work should develop rapidly in extent and in efficiency.

LOUISIANA.

Division of Agricultural Extension, Louisiana State University and Agricultural and Mechanical College, *Baton Rouge.*

W. R. Dodson, *Director.*

History.—The Louisiana Legislature passed an act for the benefit of agricultural education in 1827. An agricultural society with 13 directors was incorporated in 1833. A little later an agricultural and mechanical society was organized and erected a building at New Orleans for holding annual fairs. In 1867 the legislature appropriated $150,000 to promote the different lines of agriculture for

the Agricultural and Mechanical Fair Association, which was incorporated in 1861. This may be considered the first specific appropriation for extension work in the State. During the period from 1836 to 1906 numerous fair associations and agricultural societies were incorporated and conducted periodically with more or less success.

The present State fair association was organized in 1906. Annual fairs have been held since. Twenty-six parish fairs are now organized.

The Louisiana Agricultural and Scientific Association equipped and financed an experiment station for investigations on sugar and allied subjects prior to the passage of the Hatch Act of the Federal Government. The Louisiana Planters' Association and the Louisiana Cane Growers' Association have been influential in shaping legislation pertaining to the cane industry.

A State agricultural society was organized in 1898 through the efforts of Dr. W. C. Stubbs. Legislative act 41 of 1880 created the bureau of agriculture and immigration, composed of the governor, secretary of state, and the commissioner of agriculture. The legislature in 1884 changed the title to the bureau of agriculture, which should be composed of the commissioner of agriculture, the professor of chemistry at the State university, and the president of the institution. In 1894 the legislature changed the personnel of the commission so that it was composed of the commissioner of agriculture, the governor, and the vice president of the State university. The constitutional convention of 1898 substituted for this commission the State board of agriculture, composed of one member from each congressional district, to be appointed for six years by the governor (two members to retire every two years), the commissioner of agriculture, the governor, the vice president of the board of supervisors of the State university, and the director of the experiment station. This organization is still maintained, except that the commissioner of agriculture became an elective office in 1904.

The legislature made an appropriation for conducting farmers' institutes in 1897. Twenty institutes, from one to three days, were held that year. Forty-five were held in 1902. None have been held under the present commissioner of agriculture. Institutes, or short courses, have been held in different sections of the State by the college and the experiment-station forces out of funds provided in the general appropriations to the university.

The Agricultural and Mechanical College was established in 1874 and was merged with the university under the title of the Louisiana State University and Agricultural and Mechanical College in 1877.

The farmers' cooperative demonstration work of the United States Department of Agriculture was established in 1907 by the appoint-

ment of two traveling agents to work with the farmers in the boll-weevil section along the railroads, adjacent to the Texas border. This force was gradually increased until 1909, when there was a State agent, 4 assistants, and 39 county agents working in 41 parishes.

About 1909 the Louisiana State University and the United States Department of Agriculture entered into cooperative arrangements for conducting boys' corn-club work. A joint agent was employed to have charge of this branch of the work. A little later the girls' canning-club work was established under a similar agreement.

In 1914, when the Smith-Lever Act became operative, this organization was composed of a State agent, assistant State agent, 3 district agents, and 45 county agents. The boys' club work, with an agent in charge, and an assistant in charge of girls' canning-club work and 16 women agents were merged with other forces in the State under the division of extension.

Organization and administration.—In accordance with the agreement of the general memorandum of understanding, dated July 23, 1914, signed by the president of the university and the Secretary of Agriculture, the division of extension was created at the university. The director of extension work is also director of the experiment station.

The work of the division of extension is divided into three lines: (1) The farm-demonstration work, dealing with adults under the supervision of the State agent, an assistant State agent, and three district agents; (2) junior extension work, the supervisor of which has charge of the work in corn clubs, pig clubs, canning and poultry clubs, and also the cooperative agricultural work in the agricultural high schools; and (3) the live-stock extension service, conducted under special appropriation of the Federal Congress.

There is no direct relation between the division of extension and the experiment station, except that the director of the extension work is the director of the experiment station. The heads of the departments of the college are considered the authorities for the subject matter taught by the extension workers. All assistants and specialists are selected by the director with reference to their training and practical experience along their particular lines. The leaders of the different projects and the specialists are responsible to the director. All members of the extension division are joint representatives of the State institution and the United States Department of Agriculture, where their salaries are paid from both funds.

Publications.—In 1914–15 the junior extension department issued a weekly bulletin which was mailed out to the agricultural press of the State. It was a sheet 14 by 22 inches, printed on one side, composed of short articles on timely topics, prepared by members of the extension force and the college and experiment-station staff. Nine

circulars were published during the year for use of the extension workers. These circulars were prepared at the request of the director, and were designed to fill an urgent need for the kind of information contained. The publications were distributed by mailing out to the list kept in the director's office, in reply to requests from farmers and others interested in the subjects treated, and by the personal distribution of extension workers and county agents. There is no complete mailing list at this time, but one is in process of preparation. Each office of the division has a list of names to which the publications have been mailed.

Finances.—Cooperative extension work in agriculture and home economics in Louisiana for 1914–15 was supported by funds from the following sources:

Federal Smith-Lever	$10,000.00
College	6,847.05
County appropriations	22,587.50
United States Department of Agriculture, farmers' cooperative demonstration work	45,000.00
United States Department of Agriculture, Bureau of Animal Industry	1,954.60
Total	86,389.15

The Smith-Lever funds were used in carrying out the following projects: Administration; printing and distribution of publications; county agents', home-economics, and girls' club work; boys' club work; horticulture; dairying; and general extension work.

A detailed financial report, showing the expenditures of the above amounts, was submitted and approved, this statement showing a Smith-Lever balance of $1,376.66.

By act No. 8, house concurrent resolution No. 15, approved June 11, 1914, the Louisiana Legislature assented to the provisions of the Smith-Lever Act, and designated the Louisiana State University and Agricultural and Mechanical College to receive the benefits of the provisions of the act.

The money is paid out by the college treasurer on the submission of vouchers properly drawn, indorsed, and signed. Vouchers are made in duplicate, and copies are kept by the college treasurer and the State auditor.

Both men and women county agents are paid partly from funds from the division of extension, the United States Department of Agriculture, and local funds, contributed in the parishes where the agents are located.

SMITH-LEVER PROJECTS.

County agents.—The county-agent plan of work is recognized as the fundamental part of the extension work. The State agent is

in charge of this project and had under him, in 1914–15, an assistant, 3 district agents, a secretary, and 40 parish agents. It is contemplated to extend the county agents' work as rapidly as finances allow and interest in the work demands. The work is being conducted in 40 parishes.

The effectiveness of the work of this organization is indicated by the demand for more capable agents and the willingness of the people to put up larger sums for the salaries of better trained men, and by the general appreciation of the assistance that is being offered through the services of the county agents. The improvement of conditions on the farm in all the parishes where there is a good county agent is noticeable to the most casual observer. County agents are expected to assist in the club work, farmers' meetings, community and county fairs, and such organization work as will be beneficial to the farmers in cooperative marketing and selling of their products. Special efforts are being made to increase the corn production, not only by increasing the acreage, but by employing better agricultural methods. Demonstrations with oats have proven that it is the best small grain for Louisiana conditions, and that it can be made a profitable crop. Demonstrations in winter cover crops and summer legumes have been established and encouraged wherever possible. Draining and terracing of land have received special attention. Crop rotations and soil building have always received attention. Cotton demonstrations in the cultural method of combating the boll weevil have been systematically carried out. Live-stock demonstrations, under the supervision of specialists, were established in a number of localities. This work was particularly encouraging in the cane-growing section of the State.

The technical training and knowledge of the specialists is of much value to the agents and strengthens them in their work along all lines. The agent, in turn, places at the disposal of the specialists his knowledge of local conditions and his field experience. The combination makes a strong team.

In 1914–15 the number of acres in corn demonstrations was 35,166; average yield, 32.8 bushels per acre as against 20.5 bushels, the State's average. Seven hundred and sixty-six demonstrators planted improved seed corn; 933 were influenced to field-select their seed. There were 24,795 acres in cotton demonstrations, yielding 1,035 pounds per acre, or an increase of 540 pounds per acre over the average for the State. Fourteen thousand seven hundred and forty-six acres in oats made an average yield of 41 bushels per acre, or 16 bushels more than the State's average. About 1,000 acres in demonstrations of alfalfa; 5,000 acres in lespedeza; 290 acres in peanuts. Of velvet beans there were approximately 1,500 acres; cowpeas, 27,906 acres; Irish potatoes, 1,800 acres; sweet potatoes,

1,440 acres; home orchards, 245 acres. One hundred and forty-three orchards with 7,500 trees were pruned by the agents, and the same number were sprayed under their direction. Seventeen thousand one hundred and twenty-seven dollars and fifty cents' worth of fertilizers were bought cooperatively, a saving to the farmers of $3,558.85. Six hundred and twenty-four farmers were induced to home-mix their fertilizers. It might be noted that 50 per cent less fertilizer was bought than in 1914. Nine hundred and fourteen farmers were induced to take better care of farm manures. It is estimated that 36,050 tons of manure were saved under the agents' influence. Four hundred and forty-two tons of lime were used. There were 123 poultry demonstrations, with 7,510 birds; 182 pure-bred sheep were bought; 377 head of pure-bred beef cattle. 448 head of pure-bred dairy cattle, 1,281 head of pure-bred hogs, 126 head of pure-bred horses, and many more grade live stock of all kinds were purchased. There were 110 silos built through the agents' influence, 247 dipping vats; 215,058 head of live stock were treated through the extension workers for disease; and 17,000 head of hogs were inoculated.

Home-economics and girls' clubs.—Canning clubs, with a total membership of 2,974, were organized among the girls in 43 parishes. The girls were supplied with circulars and bulletins of instructions and given such assistance as was possible by agents and the members of the extension force in working on this project. Eleven parishes had women agents employed for the entire year to supervise and organize the work of the girls and carry on home demonstration work among the women of the rural districts. In one parish a man devoted several months of the year to club work; in other parishes women agents were employed for two or three months to do the club work during the canning season. Many farm homes were improved through the influence of the women agents or others connected with the extension work along this line. Greatly increased interest was shown in home gardens, canning of fruit and vegetables, better household methods, and the improvement in sanitation in the home. The poultry interests in the parishes of East Baton Rouge and De Soto were promoted by the women agents organizing egg-shipping clubs in several places. With proper supervision and management there are great possibilities along this line.

In the 11 parishes with women agents 1,897 members were enrolled in the girls' clubs, and 291 made reports. Sixty-two thousand one hundred and thirty containers of vegetables were put up. There were 300 members in the home demonstration work. Sixty-seven fireless cookers and four refrigerators were made, 6 homes were screened, 25 poultry demonstrations conducted, and 75 home gardens planned.

Boys' clubs.—Boys' corn clubs were organized in 49 parishes, pig clubs in 43 parishes. The work was conducted through demonstration agents and in cooperation with agricultural high-school teachers and public-school teachers. Fifty-two agricultural high schools of the State are becoming the centers of extension work among the boys and girls located about these schools. Not only the boys belonging to the clubs in the different localities, but in many cases the whole community in which these clubs are located is becoming gradually interested in better methods of corn culture and of livestock raising. In 1914–15 there were enrolled in the boys' corn clubs 1,084, in the pig clubs 856. Looking after the boys' club work is a part of the duties of all demonstration agents. In 21 parishes the county school boards and police juries appropriated directly for this work, and in these parishes the agents were required to devote more of their time to the club work than in some of the others. In all cases the principals of the high schools or the agricultural teachers were required to give a certain number of days each month to the club work in their districts. The superintendents were also required by the State superintendent to give special attention to the club work in their parishes. With this assistance the county agents were enabled to do very effective work with the boys without seriously interfering with regular demonstration work.

Trucking.—The horticulturist of the experiment station devoted not less than one-half of his time to the work under this project. His work was carried on in cooperation with the agents, and he assisted with special problems in the growing and shipping of truck crops and the controlling of insect and fungus diseases. He addressed truck-growers' meetings, conferred with the managers of truck-growers' associations, visited markets, gave special field demonstrations, and attended to the correspondence. Special attention was given to developing a winter cauliflower introduced by the experiment station. This industry has already assumed car-lot proportions and bids fair to rank among the leading truck crops of the State. Much valuable assistance has been given to truck growers throughout the State in the way of general information and assistance in critical periods.

Dairying.—This work was carried on in cooperation with the Dairy Division of the United States Department of Agriculture. Dairy specialists gave assistance to farmers in working out methods for feeding dairy cows, keeping herd records, building silos, and in selecting breeding stock.

General extension.—Under this project was included the traveling expenses of specialists in the college who were called out occasion-

ally to assist in advising county agents and holding farmers' meetings to give technical advice.

OTHER EXTENSION WORK.

Poultry.—The poultry work has been carried on for two years under the supervision of the local forces in connection with corn, pig, and canning clubs. Bulletins and instructions were sent to more than one thousand boys and girls during the year. No systematic plan of work was undertaken until the latter part of the year, when a poultry expert was employed to organize and instruct the poultry-club members. This work will be pushed in a number of communities where there seems to be sufficient interest to justify it, as apparently there is a widespread demand for this among the boys and girls of the State, and good results are expected.

Negroes.—The negro work was inaugurated late in the year. Four negro agents will be at work in the field during 1915–16. There has been one county agent at work for three years. He has given great satisfaction and rendered valuable service to negro farmers of his territory. The white agents have from the beginning listed negro demonstrators and cooperators, and in many ways assisted the negro farmers as frequently as they did the white. This work is in cooperation with the negro industrial college at Baton Rouge. The president of this institution is the district agent for the negro work, and is responsible to the director of extension.

Special live-stock extension.—Another important line of extension work which was conducted outside of the Smith-Lever projects was the live-stock extension work, which has already been mentioned under the heading of organization, which was jointly conducted under the supervision of the Bureau of Plant Industry, the Dairy Division, and the director of extension of Louisiana. Besides the superintendent of live stock there were 2 specialists in beef cattle, 1 in poultry, 1 in hogs, 1 in forage crops, 2 in dairying, and 1 in marketing. This work was carried on under a special appropriation made by Congress for the relief of the farmers in the cane-growing section of the State. At a conference with the directors of this special work it was agreed that specific demonstrations should be taken up with poultry, hogs, beef and dairy cattle, and such other work as would be necessary to provide pastures, forage crops, and grain necessary to carry on this line of work in a self-supporting manner. Certain parishes were selected to put in systematic work, demonstrations established, and in connection with the county agents and the specialist these were closely supervised and carried out. In the poultry work 29 demonstrations in 13 parishes were selected. Special attention was given to the improvement of a grade of chickens,

the production of eggs, and instructions given as to packing and marketing same, particular attention being given to the standardizing as to size, shape, and color. In hog work 33 demonstrations were selected in 11 parishes. Special attention was given to the sanitation of quarters, the use of grazing crops, balanced rations, and the proper assortment of concentrates; the grading up by the use of pure-bred sires and the production of hogs that would feed out uniformly at about 1 year of age. In the beef cattle line 20 demonstrations in 13 parishes were secured. All of these were small farm herds, the principal object being to teach how a herd can be graded up for beef production by securing pure-bred animals to head the herd. No regularly established pure-bred cattle farms were accepted as demonstrations. The forage-crop work was conducted mostly in connection with the beef-cattle and hog demonstrations and consisted in replanning the cropping system on the farm so as to produce the pasturage and grains needed in feeding the live stock used in the demonstrations.

OUTLOOK.

Extension work in Louisiana, on the whole, seems to be meeting the needs of the farmers of the State. The growing demand for the assistance of the county agent and the specialist indicates confidence and appreciation of their service. There are still problems of administrative coordination of work which will be solved as the members of the staff gain in experience and knowledge of their work. Altogether the prospects are excellent for the proper development of the extension work of the State.

MARYLAND.

Division of Extension, Maryland Agricultural College, *College Park.*

THOS. B. SYMONS, *Director.*

History.—The first organization in Maryland for the promotion of agriculture seems to have been the Agricultural Society for the Eastern Shore, formed in 1818. Its main object was to hold agricultural fairs. In early days its influence was considerable, but to-day this is not so, its main activities being those of a farmers' club, meeting regularly at the homes of its members.

The first farmers' club in the State was formed in 1842, in Montgomery County. This is still in existence.

Maryland was one of the first States to aid in the organization of the National Grange. This society celebrated its fiftieth anniversary in the State in 1915.

The Peninsula Horticultural Society was established in 1887. Its membership consisted of fruit growers, truckers, and farmers of the

Eastern Shore and Delaware. The State Horticultural Society was organized in 1898. It has been an important factor in securing legislative support for the horticultural industries of the State. Later the Maryland Corn Improvement, Dairymen's, and Beekeepers' Associations were formed. Since about 1909 these organizations have held joint exhibitions and meetings annually.

The legislature in 1847 provided for investigations in agricultural science and the dissemination of such facts through publications, addresses, demonstrations, and otherwise. It also created the office of State chemist and provided, among other things, that this officer should deliver one public lecture in each election district in each county, and then should deliver a course of public lectures in each county town. This provided for what was really the beginning of farmers' institutes in the State.

A law passed by the legislature of the State in 1856 established the Maryland Agricultural College and provided for conducting experiments. Six thousand dollars was the annual appropriation for the support of this work.

The records of the college show that in 1858 field experiments with corn, oats, and potatoes were commenced. These were afterwards interrupted by the war. The experiment station was not organized as a separate and distinct department of the agricultural college until 1888. In 1898 the State legislature passed an act providing for the inspection of orchards and nurseries and for experimental work in horticulture, and making an appropriation of $10,000 for the first year and $8,000 annually thereafter.

The board of trustees of the Maryland Agricultural College was designated as the State board of agriculture by legislative enactment of 1908, but was given no specific powers or appropriation. The legislature of 1910–12 delegated certain police duties to this board.

The first regular farmers' institute under this name was conducted during the winter of 1890. In 1894 the Maryland Legislature passed a law providing for the holding of farmers' institutes in all counties of the State and made an annual appropriation of $6,000 therefor. The legislature of 1912 appropriated $3,000 especially for extension or demonstration work. This has been continued since that date and has been expended almost entirely for horticultural work. During that same year the Office of Farmers' Cooperative Demonstration Work of the United States Department of Agriculture inaugurated extension work through county agents in three counties of southern Maryland.

The following fiscal year the work was extended to other sections of the State, under the supervision of a district agent; also girls'

canning-club work started in seven counties, a district agent supervising.

In the fiscal year 1912–13 the Office of Farm Management, United States Department of Agriculture, appointed an agent in Baltimore County. On July 1, 1913, this agent was transferred to the Office of Farmers' Cooperative Demonstration Work of that department.

Previous to July 1, 1914, all salaries and expenses of agents employed by the farmers' cooperative demonstration work were paid by the General Education Board. Upon the date mentioned the cooperation of that board with the United States Department of Agriculture ceased, and the financing of the work organized was taken over by the department.

During the session of the legislature of 1914 an act was passed allowing county fiscal courts to appropriate money for demonstration work through men and women county agents. In June, 1914, the governor of the State assented to the provisions of the Smith-Lever Act and designated the Maryland Agricultural College as the recipient of the funds. In July of that year a memorandum of understanding for conducting extension work in agriculture and home economics was signed by the Secretary of Agriculture and the president of the college.

The extension service of the Maryland Agricultural College was organized July 1, 1914, to comply with the Smith-Lever Act. A State agent in charge of the work of men county agents and two assistant State agents, in charge of boys' club work and girls' canning clubs and home-demonstration work, respectively, are under the supervision of the director; also 4 full-time specialists, including 1 woman in home economics; 9 part-time specialists; 12 men and 3 women county agents working full time.

Organization and administration.—The general plan of organization of the extension work in the college is to have the director in charge of all extension activities in the State. According to projects, the county agent is to be recognized as a fundamental part of this organization, and it is contemplated, as soon as funds are available and conditions will warrant, to place one in each county of the State.

Specialists are employed who, with one exception, have their headquarters at the college. These specialists are selected by the extension director and are administratively responsible to him.

Publications.—In 1914–15 the extension service published about 26,000 copies of a special press bulletin known as "The Farm Adviser," issued bimonthly. In addition, one column of plate matter was furnished weekly to about 100 newspapers in the State.

Finances.—During the fiscal year ending June 30, 1915, there was $41,266.24 available to be expended directly through the extension service.

Smith-Lever	$10,000.00
College appropriation	5,700.00
State appropriation	3,000.00
County and local funds	4,566.24
United States Department of Agriculture (farmers' co-operative demonstration work)	15,150.00
United States Department of Agriculture (Bureau of Animal Industry)	2,850.00
Total	41,266.24

The Smith-Lever funds were used in carrying out the following projects: Administration; printing and distribution of publications; home economics; movable schools and farmers' courses; agronomy; farm management; poultry husbandry; stenographic and clerical labor; spraying demonstrations; demonstrations for rural homes; and brown-rot demonstrations.

A detailed financial statement showing the expenditures of these funds was submitted and approved, and this statement showed an unexpended balance of $250 under the Smith-Lever fund.

SMITH-LEVER PROJECTS.

County agents.—As the project for county agents was much the largest and the most important project of extension work in the State, it is treated first in order, although it did not receive any financial support from the $10,000 Smith-Lever appropriation to the State allotted for the fiscal year in question. The Smith-Lever fund was used for the creation of an administration division and for specialists, all of whom worked through the county-agent project.

The State agent in charge of this project is cooperatively employed by the United States Department of Agriculture and the Maryland Agricultural College, each contributing toward his salary or expenses. Fourteen county agents were employed during this fiscal year. The salaries paid these men range from $1,200 to $2,300 per annum, the sources being the United States Department of Agriculture and the county fiscal courts, business organizations, and individuals. Two-thirds of these agents are college trained, and all have had extensive practical experience. A short summary of the work accomplished during the year 1915 is as follows:

Two hundred and forty-three men worked with 2,055 acres of corn, 199 men with 1,426 acres of small grains, 381 men with 3,615 acres of winter legumes, 103 men with 262 acres in meadows and pastures, 309 men with 2,542 acres of summer legumes; 178 demonstration orchards, with 6,295 trees, were pruned, sprayed, etc.

In improving the live stock of the State pure-blood animals were brought into the various counties as follows: Forty-four bulls, 162 cows or heifers, 186 hogs, and 87 sheep.

Fifteen thousand eight hundred and seventeen cattle, hogs, sheep, and horses were treated for diseases and insect pests.

Fertilizer demonstrations were conducted on 75 farms; fertilizer was bought cooperatively to the amount of $11,613, at a saving of $3,260 to the farmers.

Two hundred and fifty-six farmers were induced to take better care of farm manures; 220 silos were built in the State; 396 farmers were induced to use lime, aggregating 7,893 tons; 39 farmers' clubs were organized, with a total membership of 965.

Boys' clubs.—This work is directly under the assistant State agent, who reports to the State agent in charge of county-agent work. Practically all of the work so far has been done by the county agents, much of it in cooperation with county superintendents and teachers. During the year 1915, 320 boys were enrolled in the corn clubs and reported an average yield of 70.41 bushels; and 22 boys were enrolled in the potato clubs.

Home economics, including girls' clubs.—A woman assistant State agent has charge of this work and reports to the State agent in charge of county agents. The home-economics specialist is employed to assist the assistant State agent. During the year six county women agents were employed, three of whom were on the yearly basis. Besides working with the girls, a large amount of time was spent in helping rural clubs by lectures and demonstrations in home economics.

As a result of this work, 607 girls and 113 women were enrolled in these clubs; 8,799 containers of tomatoes, other vegetables, and fruit were canned; 194 girls made caps and aprons; 25 demonstrations were held in homes; and 5 labor-saving devices were installed.

Agronomy.—The head of the agronomy department of the experiment station is also specialist in charge of this line of work. A large part of his work has been through county agents, but he has worked as well in counties where there are no agents. During the year 1915 approximately the following number of "field tests" were conducted: In alfalfa, 14; wheat, 200; oats, 53; grass, 106; soy beans, 90. Thirty-three farmers' meetings were addressed and 16 fairs or shows attended in the capacity of grain judge.

Farm management.—The professor of soils and farm management in the agricultural college has charge of this project, which has for its purpose the replanning of farms, arrangement of buildings, handling of crops, live stock, etc. Seven county agents were assisted and 89 farms visited during the year. An assistant was employed a

part of his time for the purpose of inaugurating, through county agents, a simple system of farm accounting.

Poultry.—During the winter months a part of the time a specialist was employed in this line of extension work. Most of his work was through movable schools.

Movable schools.—During the year 12 movable schools were conducted, with an attendance of 480. Only two subjects were given at any one course, which extended for four days. A guaranty of at least 25 in attendance at all sessions, and a fee of 50 cents each, was required. All money was used by the local committee for entertainment.

Orchards and gardens.—One specialist devoted his entire time to this project, which consisted of conducting demonstrations in various parts of the State, always in cooperation with the county agent, where there was one employed. During the year 1915, 92 temporary, or one-day demonstrations were conducted, at which 1,014 persons were present; 80 orchards were visited, 3 days were spent at summer-school work, and 10 days in connection with the Maryland Week exhibit.

Orchard and truck diseases.—The specialist working under this project paid especial attention to combating diseases of the peach, apple, tomato, and potato crops. A part of his time was spent with county agents. Most of the demonstrations conducted were temporary, or for one day. Thirty-two spraying and pruning demonstrations each were conducted during the year 1915. Besides these, 43 public addresses were made and 188 calls for advice responded to.

Rural homes.—The purpose of this project was the beautifying of home grounds.

OTHER EXTENSION WORK.

Dairying.—The specialist in charge of dairy-extension work was employed cooperatively by the Dairy Division of the Bureau of Animal Industry, United States Department of Agriculture, and the extension service of the Maryland Agricultural College. As far as possible, this work was carried on in cooperation with county agents. The principal work during the past year was the formation of cow-testing and breeders' associations, assistance in the building of silos and giving advice in barn building. During the year 1915 3 cow-testing associations were formed, with a total number of 55 dairymen and an aggregate of 833 cows. During the same year 2 breeders' associations, with 20 members each, were organized. Direct assistance was given in the building of 7 silos and the remodeling or building of 4 dairy barns. The specialist took part in 3 fairs, 5 movable schools, addressed 23 dairy meetings, issued a course of

12 monthly lessons for use in rural schools, and prepared a correspondence course in dairying.

Activities of the State department.—The farmers' institutes of the State are conducted by a director, as provided by a special act of the legislature, which also appropriated $6,000 annually for that purpose. There is no official connection between the director of farmers' institutes and the director of extension work. During the fiscal year 1914–15, 69 institutes were held, with a total attendance of 29,797.

OUTLOOK.

The county-agent project has taken strong hold of the people of the State, especially in all counties where there are county agents. Very excellent work is being done through specialists, and some of this work is bringing good results. There are some very important problems of administration and coordination of effort which must be worked out in order to bring about the best results. If these matters are properly adjusted, as is confidently expected, the work will soon increase in influence and the confidence of the people generally in the State, and the results will increase in proportion.

MISSISSIPPI.

Division of Extension Work, Mississippi Agricultural and Mechanical College, *Agricultural College.*

E. R. Lloyd, *Director.*

History.—As early as November 19, 1857, the Mississippi State Legislature passed a law creating a State agricultural bureau for the promotion of agricultural and mechanical science. The membership of this bureau, as provided in the statute, was composed of the governor of the State and one member from each congressional district, elected by the legislature. The act provided for an appropriation of $1,000 and specified that $500 of this amount was to be used as premiums for a State fair to be held annually. A part of the duties of this agricultural bureau was to organize county agricultural societies which were to be subordinate branches of the bureau. These county societies were to promote the agricultural development of the several counties.

The constitution of the State, adopted May 15, 1868, provided for a commissioner of agriculture and immigration to be elected by the legislature by joint ballot, whose term of office was to be four years. The duties of this officer were to encourage agriculture and immigration and to distribute new varieties of seed.

The Mississippi Experiment Station was organized in connection with the agricultural college at Starkville, Miss., in 1883.

The agricultural college was organized in 1880, and from the time of the opening of the college until the year 1897 the members of the faculty of this institution and staff of the experiment station held a few farmers' institutes each year. In 1897 there was set aside from the experiment-station funds the sum of $500 for holding farmers' institutes. This assignment was continued each year until 1900, when the State legislature made an appropriation of $500 per year for farmers' institute work. This appropriation was increased to $1,500 per year in 1902, and to $3,000 per year in 1905. These funds were supplemented by the experiment station, and practically the entire station staff was required to do some institute work during the summer months. In 1908 the State appropriated $5,000 per year for institute work, and continued this appropriation until the year 1913, when the appropriation was increased to $9,000 per year.

The farmers' cooperative demonstration work in Mississippi was organized in the fall of 1905 by Dr. S. A. Knapp, of the United States Department of Agriculture, after conference with the president of the agricultural college.

During the season of 1906 three district agents were employed. These agents were appointed as collaborators of the United States Department of Agriculture at $1 per year. The remainder of their salaries was paid entirely by the General Education Board of New York.

In 1908 the legislature of Mississippi passed an act authorizing counties to appropriate funds for employing county demonstration agents. Under this act several counties appropriated funds to cooperate with the United States Department of Agriculture in employing county agents. The number of agents employed increased from year to year until in November, 1912, the following agents were employed: One State agent in charge of men's work; 1 assistant State agent in charge of boys' club work; 1 assistant State agent in charge of girls' club work; 2 district supervising agents; 51 white county agents in men's work; 1 negro county agent; and 12 women agents in charge of girls' club work.

On August 20, 1909, a memorandum of understanding between the United States Department of Agriculture and the Mississippi Agricultural and Mechanical College was made for the purpose of conducting cooperatively the boys' corn-club work. A State agent in charge of the boys' corn-club work was employed jointly by the department and the college with headquarters at the agricultural college, Mississippi.

The year 1914 marked the beginning of the cooperative work under what is known as the Smith-Lever Act. On May 27, 1914, the

governor of Mississippi gave his assent to the provisions of the Smith-Lever Act and designated the Mississippi Agricultural and Mechanical College, at Starkville, Miss., as the beneficiary. On June 10, 1915, representatives of the Mississippi Agricultural and Mechanical College signed the memorandum of understanding with the United States Department of Agriculture providing for the establishment of the division of extension work for the administration of all cooperative extension work in the State.

Organization and administration.—The extension division is organized as a separate department of the college, but is in close touch with the experiment station and the teaching department. Cooperation is maintained between the college and the States Relations Service, United States Department of Agriculture, in accordance with the Smith-Lever Act.

The director of the experiment station was selected as director of extension work and has charge of all extension activities in the State. He is assisted by a State agent in charge of demonstration work.

The farm-demonstration work constitutes one of the main subdivisions of the extension work. In 1914–15 the State agent was assisted by 3 district agents, 1 assistant State agent in charge of club work, and 36 county agents.

The second division of the work in point of service is what is known as the girls' canning-club and home-economics work. One woman was employed as State agent in charge of the work, assisted by 2 district supervising agents and 35 county agents.

In addition to the two main subdivisions of the work are specialists, whose duties are to collect useful information for the county agents, to assist them in actual field demonstrations, and to render such assistance to farmers in the State generally as is possible.

Plans of work are outlined cooperatively by the director, State agent, district and county agents, and where there is any special feature the specialist in this particular line is called in conference to help mature the plans. The supervising agents and the specialist make their headquarters at the agricultural and mechanical college, where they are furnished with suitable quarters and equipment.

Publications.—In 1914–15, 10 publications were issued, including bulletins and circulars. Plate material also was sent out every week, which was published in most of the county and State papers. These circulars and bulletins were prepared by members of the extension force and college faculty and were designed to meet the needs of the farmers for the kind of information contained. There was no complete mailing list, but one is being made up as rapidly as possible.

Finances.—The total resources for extension work in 1914–15 were as follows:

Smith-Lever fund	$10,000.00
College appropriation	1,987.50
United States Department of Agriculture, farmers' co-operative demonstration work	48,117.68
United States Department of Agriculture, Bureau of Animal Industry	3,076.00
State appropriation to boys' corn-club work	1,500.00
County appropriations	32,598.02
Total	97,279.20

The Smith-Lever funds were expended in carrying out the following projects: Administration, printing, home economics, animal husbandry, and marketing.

A detailed financial statement showing the expenditure of these funds was submitted and approved.

The legislature of the State does not meet until 1916, but the governor assented to the Smith-Lever Act on May 27, 1914, and designated the agricultural and mechanical college to receive any funds coming through this act. The money is first paid into the State treasurer's office and transferred to the college treasurer quarterly. It is paid out through the college treasurer on presentation of vouchers, properly drawn, indorsed and signed. The original vouchers are kept in the college treasurer's office.

The county agents, both men and women, are paid partly from funds donated by the county or individuals within the county and partly by funds from the extension division and the United States Department of Agriculture.

SMITH-LEVER PROJECT.

County agents.—As the project for county agents was much the largest and the most important project of extension work in the State, it is treated first in order, although it did not receive any financial support from the $10,000 Smith-Lever appropriation to the State allotted for the fiscal year in question. The Smith-Lever fund was used for the creation of an administration division and for specialists, all of whom worked through the county-agent project.

The following agents were employed in connection with county farm-demonstration work during the season of 1914–15: One State agent in charge, 1 assistant State agent, 3 district supervising agents, 36 county agents (white), and 5 county agents (colored). The duties of the county demonstration agent are extremely varied. He supervises a large number of demonstrations and field crops, gives advice to farmers on a great variety of agricultural questions, and is the

means of putting the farmers of the county in communication with the specialists at the college and the United States Department of Agriculture. He organizes local associations, community clubs, boys' corn clubs, live-stock associations, and assists in every way possible in bringing about more satisfactory living conditions on the farm.

The following are some of the results for the season of 1915: Seven hundred and six corn demonstrations with total of 12,697 acres, average yield of 39.7 bushels; 363 cotton demonstrations with 11,679 acres, average yield of 1,244.42 pounds seed cotton; 271 oat demonstrations with 6,831 acres, average yield of 27.3 bushels; 30 wheat demonstrations with 1,552 acres, average yield of 23.28 bushels; 262 lespedeza demonstrations with 4,341½ acres, average yield, 1.90 tons; 229 crimson-clover demonstrations with 1,805 acres, average yield, 3 tons; 28 bur-clover demonstrations with 89½ acres, average yield, 104.61 tons per acre; 19 vetch and oats demonstrations with 310 acres, average yield, 1.74 tons; 45 alfalfa demonstrations with 1,388.9 acres, average yield, 5.57 tons per acre; 1,170 demonstrations in clover cover crops; 7,833 hogs fed and cared for according to advice of agents; 6 pure-blood rams and 15 ewes imported; 37 flocks of sheep started; 115,000 cattle treated for blackleg and other diseases; 42,518 hogs treated for cholera and other diseases; 26 dipping vats constructed; 36,124 cattle dipped; 115 silos built; 114 other buildings erected; 757 farmers induced to adopt systematic rotation; and 2,111 terrace demonstrations.

Boys' clubs.—The boys' club work is supervised by the assistant State agent and one assistant, who devotes his attention largely to the boys' pig-club work. The work is carried on through the county demonstration agents and the county superintendents of education.

There were enrolled 4,082 boys in the boys' corn clubs during 1915. The average yield per acre of corn for the boys of the entire State was 49.73 bushels, made at an average cost of 47.4 cents. The boys were organized into community clubs and from time to time received instructions from the State and county agents in the best methods of growing and handling the different staple crops and other farm problems.

One thousand eight hundred and seven boys were enrolled in the pig clubs in 1915, and 560 of these boys secured pure-bred pigs.

Girls' clubs and home economics.—The girls' clubs and home economics work is carried on by women agents, who give instructions to farm women in home economics, domestic arts, and allied subjects by conducting demonstrations, organizing clubs for the study and demonstration of better methods of canning and preserving fruits and vegetables, better household equipment, home conveniences, and the marketing of home products. This work was

under the supervision of the State agent and 2 district supervising agents, and 35 county agents in 1914–15.

In 1915 there were 3,572 girls enrolled in canning clubs, 561 in poultry clubs, and 1,194 women in the home-demonstration clubs. The county agents held 3,805 meetings. The value of canned products marketed by the girls was $35,796.

Animal husbandry.—Two specialists were employed in this work to encourage the breeding of more and better live stock and to give instructions in the care and feeding of farm animals. They assisted farmers who were inexperienced in the selection of breeding stock and gave instructions in the keeping of accurate records of work done at each farm under their supervision. This work was carried on in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. Through the agents the specialists placed 87 pure-blood stallions, 92 jacks, 72 brood mares, 99 pure-blood beef bulls, 398 boars, and 962 sows.

Marketing.—A specialist was employed to have charge of this work, who organized marketing and trucking clubs, gave advice as to the products in demand and where the demand existed, and gave demonstrations in curing and storing products on the farm. This project was carried on in cooperation with the Office of Markets, United States Department of Agriculture.

OTHER EXTENSION WORK.

Horticulture.—One specialist was employed in charge of this work to encourage the planting and proper care of home orchards. The work of this specialist was carried on through the county agents. One thousand seven hundred and sixty-three demonstration orchards, with 81,763 trees, were visited in cooperation with county agents and instructions given in setting, pruning, spraying, and cultivation.

Agricultural teaching.—One specialist was employed to work in cooperation with the agricultural high schools of the State in giving instructions as to the best methods of teaching agriculture in schools. This work was supported entirely by State funds.

Community organization.—This work was carried on by a specialist, who gave instructions to farmers in methods of community organization and assisted county agents in perfecting community organizations in their counties.

Farm management.—A specialist was in charge of this work and worked in cooperation with county agents in making farm surveys and giving advice and instruction regarding methods of farm management and accounting.

Agricultural engineering.—A specialist was employed in this work to make plans for better farm buildings and the installing of drain-

age systems. This work was carried on in cooperation with the Office of Rural Engineering, United States Department of Agriculture.

Movable schools.—The movable schools were held principally at the county agricultural high schools by members of the extension staff. The work was supported entirely by State funds.

Dairying.—Three specialists had charge of the extension work in dairying. The lines of work undertaken under this project were instructions to farmers concerning methods of feeding and management of dairy cattle, erection of silos, dairy barns, buildings and equipment for creameries, organizing cream routes, keeping records of dairy herds, and selection of breeding stock. Wherever possible the dairy specialists worked through the county agents. This work was carried on in cooperation with the Dairy Division of the United States Department of Agriculture. In cooperation with county agents, 77 pure-blood dairy bulls, 238 pure-blood cows, and 229 grade cows were imported.

OUTLOOK.

The extension work is meeting with the enthusiastic support of the farmers and business men of the State. It has been an easy matter to secure local support for county-agent work from the county authorities, and the work is growing and developing as fast as trained men can be found to do the work. The cooperating forces are gradually drawing together, resulting in good cooperation. As the extension division gains in experience the work will increase in efficiency. The prospects indicate a very strong organization engaged in the effective work of carrying information from the various institutions interested to the people.

NORTH CAROLINA.

Division of Extension Service, North Carolina College of Agriculture and Mechanic Arts, *West Raleigh.*

B. W. Kilgore, *Director.*

History.—The State department of agriculture was organized in North Carolina in 1877, and conducting an agricultural experiment station was to be a part of its duties. The College of Agriculture and Mechanic Arts opened in 1889, and included an experiment station under the Hatch Act. In recent years the two stations have been united and are jointly financed by the State department of agriculture and the college. The State department of agriculture is governed by a board of agriculture and the State commissioner of agriculture, who is the chairman of the board. The chief duty of the State department of agriculture has been regulatory work; it

has also issued various agricultural publications to the farmers since 1880.

The board of agriculture has been conducting institutes since 1890. The forces of the college, the experiment station, State department of agriculture, and good farmers over the State have been utilized as speakers in this institute work. Eight branch experiment stations have been conducted; the results from which have been used by the experiment-station staff and the extension service.

The State Agricultural Society was established in 1852, and since that time 55 fairs have been held under its auspices. The fair grounds are now located near the college and experiment station. The college, the experiment station, and the State department of agriculture have been extensively interested in these fairs during recent years. County fairs have been held during the past 10 years.

There has been a close relationship between the State department of agriculture and the College of Agriculture and Mechanic Arts throughout its history. The members of the State board of agriculture, with few exceptions, have been trustees of the college. At present both institutions have separate boards. Since 1912 a joint committee for agricultural work has been agreed upon by the two institutions. This arrangement was authorized by the legislature in 1913. Since that date a committee has had charge of all the State experiment and extension work in agriculture in cooperation with the Federal Department of Agriculture. All teaching is left to the college. Police or inspection work is done entirely by the State department of agriculture. The plan has worked most satisfactorily. The State department of agriculture employed a man to do demonstration work with the farmers in 1906.

In 1908 the professor of agricultural-extension work was appointed for the college, a part of whose duties was to conduct boys' corn clubs. Later this work was made cooperative between the State institutions and the department.

In 1912 the headquarters of the farmers' cooperative demonstration work were moved from Statesville to Raleigh. In this year the United States Department of Agriculture, the State department of agriculture, and the College of Agriculture and Mechanic Arts entered into an agreement to conduct all extension work jointly. This action was recognized by the legislature in 1913, and the extension and demonstration work was made a division of the experiment station, which arrangement continued until the passage of the Smith-Lever Act.

The Smith-Lever funds were accepted by the governor on June 10, 1914, to be administered by the agricultural and mechanical college. The legislature approved this in a certain resolution on March 5, 1915, and made appropriations to meet the State's requirements.

The farmers' cooperative demonstration work of the United States Department of Agriculture was introduced into North Carolina in 1907 by the appointment of a State agent. In 1908 there were eight counties organized under this work. In 1909 it had extended to 16 counties. In 1910, to 24 counties, and for the first time local funds were contributed by some of the counties to help finance the work. In 1911 the work was carried on in 30 counties, all of which made some contributions to the agents' salaries. The first local contributions were small. They have gradually increased until the amount averages $600 to a county.

In 1911 the canning-club work was organized in 10 counties. In 1913 a cooperative arrangement between the United States Department of Agriculture and the State department of agriculture was made, and since that time the State department of agriculture has contributed to the finances of the work. Agents were appointed as collaborators at $1 per year by the United States Department of Agriculture, the remainder of their salaries being paid by the General Education Board of New York. The General Education Board continued to furnish money through the United States Department of Agriculture until July 1, 1914, when the funds furnished by it were entirely replaced by those of the department, and the board's connection with the extension work terminated.

Organization and administration.—Through a memorandum of understanding, dated September 1, 1914, the United States Department of Agriculture and the North Carolina College of Agriculture and Mechanic Arts, with a further agreement between the College of Agriculture and Mechanic Arts and the State department of agriculture, the extension work was made a separate division of these two institutions and is conducted under the joint committee for agricultural work provided for in chapter 68, Public Laws of 1913, and in cooperation with the United States Department of Agriculture as approved in project agreement No. 1, entitled "General organization project of cooperative extension work and home economics in North Carolina."

The director of extension, who is also the director of the experiment station, represents all the institutions having to do with the extension work in the State. All extension workers in these institutions were made a part of the extension service. Extension specialists are placed in the different divisions of the experiment station and are responsible to the heads of their divisions for the subject matter taught in extension work. The field work of the specialists is directed by the extension officers who have charge of the administration of the different projects. This agreement brings the extension service into close relationship with all the other agricultural institutions of the State. The extension service cooperates with the State

department of agriculture in its publications and in instruction in farmers' institutes. Cooperation is maintained between the college and the State department of agriculture in North Carolina and the States Relations Service of the United States Department of Agriculture, both in accordance with the terms of the Smith-Lever Act and by direct contribution of funds in support of the county agents' work.

The extension service consisted of a director and 18 full-time extension workers in 1914–15. There were 11 other men giving approximately half of their time to the extension service, the remainder of their time being devoted to experiment-station work and teaching in the college. In addition to these, there were 66 men county agents and 32 women county agents. The supervising agents in the extension force and the specialists are housed in the buildings of the College of Agriculture and Mechanic Arts and the State department of agriculture. Offices have been supplied by these two institutions and in the main equipped by them. It has been necessary to buy very little furniture, library, or other material.

Publications.—The only publication issued by the extension service before June 30, 1915, was a circular, No. 1, on Some Important Tomato Diseases in North Carolina. There was an issue of 10,000 copies, used mostly in the canning-club work. On February 13, 1915, The Extension News was started as a four-column sheet; later it was increased to five columns. Twenty issues were published up to June 30, 1915, and distributed to demonstration agents, county superintendents of education, agricultural newspapers, workers in the State department of agriculture, college of agriculture, and the experiment station, and a list of teachers and superintendents of the city schools, averaging 1,000 copies to each issue. The office also printed 232 circular letters, with a total issue of 226,480 copies. These were principally used in the boys' agricultural clubs and the girls' canning clubs. Distribution of the publications was made in several ways. There was a mailing list of 75,000 names; this was composed of the experiment-station workers of the States, a general list of the citizens of North Carolina (to whom all bulletins are sent), and numerous special lists who only get bulletins and circulars in regard to particular subjects. A general mailing list was kept for persons outside of the State.

Finances.—The cooperative extension work in agriculture and home economics in North Carolina for 1914–15 was supported by funds from the following sources:

Federal Smith-Lever	$10,000.00
Agricultural college	1,525.00
State department of agriculture	31,900.00

County appropriations	$38,000.00
United States Department of Agriculture, farmers' cooperative demonstration work	41,000.00
United States Department of Agriculture, Bureau of Animal Industry	11,283.39
Total	133,708.39

A detailed financial report, showing the expenditure of the above amounts, was submitted and approved.

The Smith-Lever funds were used in carrying out the following projects: Administration, printing and distribution of publications, county agents' work, home economics, boys' club work, dairy extension, fruit, and trucking.

By an act of the North Carolina Legislature the trustees of the College of Agriculture and Mechanic Arts were authorized to accept from the United States Government money coming to the State of North Carolina from the Government under the terms of the Smith-Lever Agricultural Extension Act. The money is paid out through the treasurer of the institution upon presentation of vouchers properly drawn, indorsed, and signed. All vouchers are made in duplicate, and copies are kept on file in the offices of the treasurer of the college and the State auditor. County agents in North Carolina are paid partly by the county or local people and partly by funds from the extension service and the United States Department of Agriculture. This arrangement applies to both men and women agents.

SMITH-LEVER PROJECTS.

County agents.—The county agents' work is recognized as the fundamental part of the division of extension. It is contemplated to have a man and a woman agent in all the counties of the State as soon as funds are available and there is a sufficient demand for the work in the county.

The State agent is in general charge of county agents and the boys' corn-club work. He had an assistant, who had charge of the boys' club work, with 3 specialists under him, 3 district agents, and 66 county agents.

The effectiveness of the county demonstration work is ascertained by observing the general improvement in the conditions on the average farm throughout the State.

Besides establishing demonstrations and giving instructions in general farm crops, the agents are expected to work up interest in farmers' meetings, community fairs, county fairs, and in such organization work as will be beneficial to the farmers in cooperative marketing and selling of their products.

A brief summary of some of the most important things which were accomplished through the agents' work is as follows:

Nine thousand two hundred and five acres in corn, yielding 45 bushels per acre; 3,978 acres of cotton, 1,483 pounds per acre; 7,096 acres of wheat, 31 bushels per acre; 20,073 acres of grasses and clovers, 2.7 tons per acre. Assistance was rendered in pruning, spraying, and planting 579 orchards, total of 282,756 trees. There were 234 head of pure-bred cattle brought into the State; 2 creameries established; 83 cream routes started; 474 demonstrations in poultry, with 23,481 fowls; 29,756 hogs treated for cholera by the agents; 145 silos built; 20,581 farmers advised regarding fertilizers; 133 community organizations formed to buy cooperatively, resulting in the saving of $26,995; 2,928 farmers induced to adopt home mixing of fertilizers, at a saving of $3.73 per ton; 164 manure spreaders placed; 3,620 farmers using lime; 32,385 acres inoculated. Agents assisted in installing 214 water systems and 331 lighting systems. Four thousand eight hundred and fifty-three homes were screened; 45 telephone systems installed; 2,056 pastures established, with 16,289 acres; 324 drainage systems started; 3,045 acres tile-drained; 14,285 open ditches made; 1,228 farms terraced; 7,511 gardens improved. Also there were purchased 175 binders, 643 mowers, 125 hay presses, 819 grain drills, 111 ensilage cutters, 249 gas engines, 819 disk harrows, 536 cream separators, 296 two-horse cultivators, 2,545 one-horse cultivators, and 229 spraying machines.

The county agents visited 85,898 farms, were called on personally and by telephone 23,012 times, held 2,108 farm meetings with an attendance of 171,739, conducted 511 field meetings with an attendance of 9,115, wrote 31,308 official letters, mailed out 16,099 circular letters, distributed 153,205 United States Department of Agriculture bulletins and 52,592 State bulletins, traveled by rail 70,588 miles, by team and otherwise 256,312 miles, organized 170 community clubs, and induced the farmers to plant cover crops of crimson clover, rye, red clover, and vetch on 476,649 acres, which if estimated at $10 per acre would mean a resource to the State of $4,766,490.

Miscellaneous work of the State, district, and club agents was as follows:

Three hundred and sixty-six visits to county agents, 403 meetings addressed with total attendance of 58,747, 1,732 conferences held, 10,667 official letters written, 130,216 official circulars, 2,820 United States Department of Agriculture bulletins and 5,142 State department of agriculture bulletins mailed out. The number of services rendered to farmers and club members, excluding visitors, conferences, and letters, totaled 196,925. They traveled 65,571 miles by rail and 5,667 by team and otherwise.

Home economics and girls' clubs.—Home economics, including girls' club work (organized as girls' canning club), was organized in 1911 with agents working in 10 counties. One thousand dollars was furnished by the United States Department of Agriculture and $4,000 or $5,000 from local funds. In 1914–15 there were 32 counties, with a total enrollment of 3,889 members. During the first two years the work was confined almost entirely to the canning of tomatoes. It is now extended to include peaches, peas, beans, soup mixtures, corn, berries, chowchow, etc. The quality of these goods has become well established, and there is quite a demand for them. There was no difficulty in disposing of the 1915 output, as shown by the State agent's report. A number of girls made quite a little profit in growing their crops, and the State agent reported that in 16 counties in which this work was carried on there were 109 girls paying their tuition in school, wholly or in part, from the profits of their canning-club work. A brief summary of results in this work for 1915 is as follows:

Total amount of products canned in tin or glass, 633,447 quarts; value of products sold, fresh and used at home, $6,025.61; total value of products, $104,241.89; total cost of products, $28,985.46; total profit, $75,256.43; average cost per member, $15.37; average profit per member, $39.90.

Boys' clubs.—Besides the assistant State agent in charge of the boys' clubs there was an assistant in charge of the corn clubs, pig clubs, and poultry clubs. The county demonstration agents were required to assist the club specialist in this work. The results were exceedingly satisfactory where the teachers and county superintendents cooperated in the work with the specialist. For the first few years the boys' club work was confined to corn alone. It has now been extended to include pigs, poultry, peanuts, cotton, and crop rotation clubs.

For 1915 the total enrollment in the boys' corn clubs was 3,504, of which 1,318 rendered complete reports at the end of the season. The average yield was 53.2 bushels per acre, with average cost of 43.6 cents. Fifty boys average 111.7 bushels per acre, and the lowest record as to cost was a little over 11 cents per bushel. Over 50 per cent of the boys had cover crops on their acres for 1916.

Dairying.—The dairy-extension work was in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, employing four men to work on this project who were specialists, their chief work being to assist the farmers and county agents to create a greater interest in the dairy industry throughout the State. One assistant was assigned to the mountainous section of the State to establish work in cheese making. It was thought by

this method that the people who were remote from the markets could convert cream and milk into cheese, and in this way make their business more profitable. Several small factories were started, which produced a good product and little difficulty was found in marketing same at fair prices. Two assistants were assigned to the tick-free territory of the State. They gave personal instruction to farmers concerning the best methods of feeding and the management of dairy cattle.

Through the erection of silos and dairy barns, the improvement of methods of marketing the products, introduction of milk records, and in various other ways, the specialists assisted in building up the dairy interest in this section of the State. Two creameries were also established and a number of cream routes started. These assistants worked in close cooperation with the county agents, and through the joint extension great progress was made during the year.

Fruit and truck growing.—In this line one specialist was employed to work with the farmers and the county agents and to give instructions as to the best known methods of growing fruits and vegetables. Much was done in helping the farmers properly to prune, spray, cultivate, and fertilize the orchards already established, and assistance was also given in planting out new orchards and in packing and marketing the products. Assistance was given by these specialists, working with the county agents, in establishing 576 orchards, containing 282,756 trees. Considerable work was done in advising along all lines of truck growing and establishing better home gardens.

OTHER EXTENSION WORK.

Negro clubs.—An organization for negro boys' farm clubs, in cooperation with the Negro Agricultural and Technical College at Greensboro, was started this year under the general supervision of the assistant State agent in club work. A negro agent was appointed to look after these clubs and will work out from the negro college at Greensboro.

Poultry.—The poultry-club work was in cooperation with the Bureau of Animal Industry, United States Department of Agriculture. A great deal was done in the way of giving instruction to the young people and the women on the farm in the handling of poultry and especially in the matter of feeding and housing. The beginners were urged to procure good stock and attend to them in such a way as to get eggs during the season when they command the best prices. There were enrolled in this club 1,000 members in 1915.

Pig clubs.—The pig-club work was in cooperation with the Bureau of Animal Industry, United States Department of Agriculture.

Valuable instructions were given in the care of pigs and the boys urged to secure pure-bred stock. Some communities were making a specialty of raising hogs to sell for breeding stock. There were 747 members of the pig clubs, of which 454 made reports. The average cost per pound of gain in all hogs was 5¼ cents.

Live stock.—The live-stock extension work was in cooperation with the Bureau of Animal Industry, United States Department of Agriculture.

Four specialists were employed in this line of work, which includes all the extension work with beef cattle, sheep, and swine. The beef cattle work in 1914–15 was confined to the beef-cattle industry in the tick-free territory, but assistance and information were given in all parts of the State. Specialists worked in direct cooperation with the county agents and assisted in organizing live-stock associations in cooperative buying of pure-bred animals, and through their influence a great many were brought into the State within the last year. They gave special instruction in feeding, planning barns, building silos, establishing good pastures, etc. Probably the greatest interest was shown in the western part of the State, which is peculiarly adapted to the live-stock industry.

Agronomy.—The leader of this project rendered valuable service to the farmers in the field and to the county agents in giving them technical instructions based upon the various experiment records obtained from the State experiment farms, as to the best methods of preparation, cultivation, kind of crops to grow, suitable fertilizers, and in the breeding and selection of seed, and also the handling of the various crops. Among the special features is the work with the farmers in growing of soy beans in the eastern part of the State, where this has become quite an industry, and the crop is now being utilized in the oil mills for the production of oil and soy-bean meal.

Grading and marketing of cotton.—This project was in cooperation with the office of markets, United States Department of Agriculture.

The object of this work was to give instruction in the grading and classification of cotton to the different county organizations and individuals and to demonstrate to them the importance of grading and classifying cotton. The purpose of this work was also to instruct the farmers in the handling of their crop and, so far as practicable, have whole communities plant the same varieties, in order to obtain uniform grades. This was pushed especially in a few counties and resulted in a considerable gain to the farmers by enabling them to get prices above that being paid by local markets.

Drainage.—The drainage-extension work was in cooperation with the Office of Public Roads and Rural Engineering.

The leader of this project assisted the county agents and individual farmers in laying out drainage systems, putting in of tile drains, and terracing land. The results of this work may be observed throughout the State, and it is being pushed actively by the agents in their respective territories. To give some idea of the extent of the work, we give a partial report, as follows: Three hundred and twenty-four drainage systems were established, 3,045 acres were tile drained, 14,285 acres were drained by open drains, and 1,224 farms were wholly or partly terraced.

OUTLOOK.

A great number of people have been reached by the extension service, and the relationship existing among the workers of the various projects has been of the very best. The work is growing rapidly, and the outlook for the future is all that could be desired.

OKLAHOMA.

Division of Extension, Oklahoma Agricultural and Mechanical College, *Stillwater.*

W. D. Bentley, *Director.*
[James A. Wilson appointed director May 16, 1916.]

History.—The first record of extension work in Oklahoma was from 1895 to 1899, when certain members of the agricultural staff of the college and experiment station were sent into the field. In 1904 the director of the experiment station, the secretary of the board of agriculture, and the veterinarian at the agricultural and mechanical college carried on some work in the cotton-growing counties of the State. There was spasmodic extension work done throughout the State from this date until 1910, when the work was somewhat organized.

The extension work was recognized in 1901 by a law providing for a board of agriculture and county institutes among the farmers, and certain appropriations were made for carrying on the work. These institutes, however, were partly political in nature, as delegates were elected at them to a convention that selected members for the board of agriculture. Members of the faculty of the agricultural and mechanical college and other agricultural speakers were represented on the programs.

There is some doubt as to when the first fairs were held in the State. As far back as 1894 there was one held at Norman. The Payne County Fair was held in 1896, and the Logan County Fair in 1897. The Oklahoma City Fair was held in 1904, from which developed the Oklahoma State Fair, which was started in 1907.

The Horticultural Society was organized in 1892, and in 1893 the Oklahoma Agricultural Society was organized at Guthrie. The

Corn Growers' Association was organized some time before 1904. Various agricultural societies have been organized in Oklahoma, but most of them were short lived and local in scope.

The first board of agriculture for the Territory of Oklahoma was created by an act of the legislature on March 8, 1901. In 1907 this was succeeded by the State board of agriculture, created by the constitution of Oklahoma. The first session of the State legislature in 1908 drafted laws giving the State board of agriculture great power. About 1913 the method of selecting members of the board of agriculture was changed to a system of appointment by the governor. By the State constitution the State board of agriculture is the board of regents for the college and the six district agricultural schools. It also has regulatory power for enforcing the inspection laws of the State. There is no commissioner of agriculture.

Farmers' institutes were first authorized by an act of the legislature, approved March 8, 1911. A systematic attempt was made to hold institutes throughout the entire Territory as early as 1903, at which time institutes were organized and held in every county except one. The first appropriation for institutes was made in 1908. The extension work of the agricultural and mechanical college was not recognized by direct appropriation until after this date.

The agricultural and mechanical college was first established by an act of the first territorial assembly on December 25, 1890. The first building was erected in 1892. The experiment station was organized as a part of the college about the same time.

The farmers' cooperative demonstration work of the Bureau of Plant Industry, United States Department of Agriculture, was begun in Oklahoma in 1907 and 1908, by two agents establishing demonstrations in a few counties adjacent to the railroad lines. In 1909, there were 14 county agents working in 23 counties. The work was gradually increased until 1910–11, when there were 34 agents. During this year there was an agent appointed to take charge of the club work. The business men and other interested people helped to pay a part of the agents' salaries. The girls' club work was begun about 1912.

The law creating the board of agriculture also provided for the publication of monthly bulletins for the information of the farmers. The extension bulletin of the agricultural and mechanical college was printed as early as 1908. "The New Education," a publication in the nature of an extension periodical, was published from 1909 to 1915. The present series of extension circulars began in 1914.

A general memorandum of understanding was signed by the president of the college and the Secretary of Agriculture on August 22, 1914, which outlined plans for combining the farmers' cooperative demonstration work, United States Department of Agricul-

ture, and all the extension work of the agricultural and mechanical college. The governor assented to the acceptance of this act on May 22, 1914, and the legislature assented on February 10, 1915.

Organization and administration.—On July 1, 1914, the position of dean of the agricultural and mechanical college was changed to that of director of extension; and the State agent of the farmers' cooperative demonstration work was elected director of extension and State agent. This new organization, as constituted in 1914–15, had a director and State agent, 2 assistants in charge of club work, 4 district agents, 54 men county agents and 17 women county agents, 1 negro man agent, and 1 negro woman agent, employed in cooperation with the Agricultural and Normal University at Langston, who is to work with the negro women and girls in five counties.

The only extension specialists in 1914–15 were one in rural hygiene and sanitation, one in hog cholera, and one in dairy work. The last two were in cooperation with the Bureau of Animal Industry, United States Department of Agriculture.

The heads of the various divisions of the college furnished expert information and instruction to the county agents and other extension workers and also aided in conducting short courses and encampment schools.

At a meeting of the board of agriculture, August, 1914, it was agreed that the Federal Smith-Lever fund of $10,000 for the fiscal year of 1914–15 be used in the employment of county agents, both men and women. It was also agreed by the board that the county-agents' work should be the leading factor in all extension work of the Oklahoma Agricultural and Mechanical College, and that efforts should be made to place men agents, working full time, in every county in the State as rapidly as possible and women agents in each county for at least nine months of the year to conduct the girls' club and the home-economics work. It was also planned to add specialists to the extension force as rapidly as possible and as the necessity for them developed.

The supervision of all extension work is under the director of the division of extension. The headquarters for all the work with the records were moved from Oklahoma City to Stillwater in August, 1914. On August 6, 1914, fire destroyed Morrill Hall, and all the records of both the Federal department and the college extension were lost.

Publications.—All the extension circulars were printed at the college printing plant and were paid for out of college funds in 1914–15. It was hard to fill the demand for extension literature during the year, as the entire surplus supply of the college was destroyed by fire. New circulars, however, were prepared and printed as fast as possible. Altogether 16 circulars were published, totaling 28,500 copies, with

1,254,000 pages. These circulars were prepared by members of the extension, experiment-station, and college forces, and treated of timely subjects in a simple and popular style.

Finances.—The total resources for the extension division of the fiscal year 1914–15 were as follows:

Federal Smith-Lever fund	$10,000.00
College fund	18,114.90
County and other local funds	32,923.08
United States Department of Agriculture, farmers' cooperative demonstration work	42,000.00
United States Department of Agriculture, Bureau of Animal Industry	234.00
Total	103,271.98

The Smith-Lever funds were used in carrying out the following projects: County agents' work, canning-club work, rural sanitation, equipment, and supplies.

A detailed financial statement, showing the expenditures of these funds, was submitted and approved, this statement showing a Smith-Lever balance of $538.18.

By an act of the Oklahoma Legislature the trustees of the Oklahoma Agricultural and Mechanical College were authorized to receive all moneys appropriated under the Smith-Lever Act and to pay it out through the treasurer upon the presentation of vouchers, properly drawn, indorsed, and signed. All vouchers are made in triplicate and copies kept on file in the office of the treasurer of the college, State auditor, and the director of extension work. These vouchers are numbered and also show to which project the money is allotted.

SMITH-LEVER PROJECTS.

County agents.—As stated before, county agents' work is recognized as the leading and fundamental part of the extension work in the State. At the end of the fiscal year 1914–15, there were 54 county agents working full time, with an average salary of $100 per month. All counties are required to put up a part of the agent's salary. The agents pay their own expenses and in many cases must provide themselves with a conveyance. Frequently the county or the local citizens provide conveyance, office accommodations, and office help for the agent.

The county agents were notified during the agents' meeting at the college July, 1914, that in the future they would be joint representatives of the college and the United States Department of Agriculture. Besides giving instructions and carrying on field demonstrations with the farmers with the regular staple crops, the agents gave special attention to stamping out hog cholera and the cattle tick. In this they worked cooperatively with the specialists sent out from the

Bureau of Animal Industry, United States Department of Agriculture. The agents also assisted in the organization of farmers' clubs and worked up interest in movable schools and assisted in the boys' club work.

A partial summary of the results in demonstrations, taken from the director's annual report of 1915, follows: Corn, 1,119 demonstrations, averaging 44 bushels per acre, an increase of 15 bushels over the State's average; 776 demonstrators planted improved seed; 2,277 other farmers were influenced to select seed for the next year's planting; 442 demonstrations with feterita, milo, and Kafir, made an average yield of 37 bushels per acre, or about 10 bushels more than the State's average; cotton, 556, averaged 914 pounds seed cotton per acre, or an increase of 410 pounds over the State's average; 276 demonstrators planted selected cotton seed; 324 were induced to field-select for next year's crop; oats, 116, gave an average yield of 42 bushels per acre, or 16 bushels over the State's average; wheat 127, yielded 21 bushels to the acre, or 11 more than the average; alfalfa 168, gave an average yield of 5 tons per acre; 102 of these used inoculating material from the department; Sudan grass 247, made an average yield of 4.3 tons; peanuts 175, averaged 45 bushels per acre, or 11 bushels more than the State's average; assistance in planting, pruning, and spraying was given to 908 orchards, with total of 254,124 trees.

The following pure-bred live stock were brought in for breeding purposes: Two hundred and thirteen horses and mares; 1,697 dairy cattle; 3,888 beef cattle; 1,729 hogs; 305 sheep. There were 136 poultry demonstrations, with 9,840 birds; poultry management was improved on 1,638 farms, with total number of 46,285 birds. There were 53,653 cattle treated for blackleg; 67 for anthrax; 4,058 for tuberculosis; 155,042 for ticks; 11,650 for lice; 9,616 for other diseases; 36,722 hogs given single treatment for cholera, and 92,796 the double treatment for cholera; 1,209 farmers induced to take better care of manure; 571 silos built in the State during the year, 313 built by the agents; 220 dipping vats built, 124 by the agents; 185 farmers' clubs organized; 47 home water systems installed; 18 lighting systems; 441 home grounds improved; 1,016 home sanitary conditions improved; 1,592 homes screened against flies; 721 fly traps installed; 255 rotations started; 237 pastures; 36 drainage systems; 131 farms drained; stumps removed from 4,479 acres; 255 farms terraced; 2,611 home gardens planned; 1,415 binders, 667 mowers, 385 hay rakes, 137 hay presses, 639 grain drills, 76 ensilage cutters, 339 gas engines, 639 disk harrows, 300 cream separators, 344 two-horse cultivators, 76 spraying machines, and a large number of small implements bought.

More than 50,000 visits to demonstration farms and others were made by the agents; the agents were called on personally 20,880 times, and 13,494 times by telephone; 2,398 field and other meetings were held, with total attendance of 151,182; 125,165 United States Department of Agriculture bulletins, circulars, etc., were distributed, and 70,495 State bulletins, etc.; 38 county fairs were held; 6,926 demonstrators, cooperators, and club members had exhibits; 102 farmers kept complete cost records; 5,434 farmers selected seed in the field; 690 farmers grew improved seed for sale; 50.4 per cent of all demonstrators and cooperators raised home-grown supplies; 37 per cent owned their farms.

Boys' clubs.—The boys' club work was organized in 63 counties in 1914–15; 42 of these counties had men agents to assist in the club organization, and some of the others had women agents to assist in counties where there were no men. Before the cooperation between the college and the department was entered into there were two club organizations, one from the college and one from the demonstration forces. They are now united into one organization. Eight hundred and sixty-one club members made exhibits of their club products at the fairs; 99 county teams of 10 boys or girls in the various clubs sent exhibits to the State fair to compete for premiums offered for county team club work. The total amount won by the club members in local, county and State fairs in 1914 was $11,001.21.

The boys' clubs enrolled 6,251 members, 1,864 making reports. The average yield of corn was 47.3 bushels; Kafir corn, 41.3 bushels; 610 pounds seed cotton; 53.3 bushels peanuts. Two hundred and eleven boys had pigs, which made an average gain of 203 pounds each in 4 months.

Girls' clubs and home demonstrations.—There were 5,213 girls enrolled in the girls' clubs, 404 reporting; 34,227 containers of vegetables, fruits, etc., were put up by the girls; 144 girls in the canning clubs in 23 counties exhibited 1,693 jars of fruits and vegetables at the State fair. The fair association offered $140 in prizes. For all first-prize winners in canning, poultry, and better-bread clubs in the counties a trip was offered to the State fair school for one week; 63 girls attended. All second-prize winners had a free trip to the farmers' winter short course, and 23 girls attended this course. Two $100 scholarships were offered to the girls making the best grade at the State fair school and the farmers' winter short course.

Rural sanitation.—The specialist in charge of this work prepared circulars, lectured at movable schools and farmers' meetings, and gave advice to county agents along the lines of home sanitation, ventilation and heating of dwellings, the prevention of diseases, eradication of insects, etc.

OUTLOOK.

The outlook for extension work in Oklahoma is altogether encouraging. The counties and the local people are giving liberal support toward the salaries of the county agents, both men and women. The people seem to appreciate an efficient county agent. The county agents' plan of conducting agricultural and home-economics extension work is believed to be the most effective means of reaching and being of service to the great body of farming people in Oklahoma.

SOUTH CAROLINA.

Division of Extension, Clemson Agricultural College of South Carolina.

Clemson College.

W. W. Long, *Director.*

As early as 1888 the legislature of South Carolina directed the State board of agriculture to hold farmers' institutes, and a limited number of institutes were held each year until the board was abolished in 1890. Still earlier, experimental work in agriculture had been begun under the auspices of the University of South Carolina at Columbia (in 1882) and the board of agriculture, which resulted in the establishment of the South Carolina Experiment Station as a department of Clemson College in 1890. In 1893 the control of the farmers' institutes was transferred to Clemson College. The institutes were developed under the general supervision of the director of experiment stations, and a limited number were held yearly by request of a certain number of farmers in a given locality. In 1908 the institutes were held in 18 counties and attended by about 13,000 farmers. During the spring of 1907 an agricultural train, carrying lecturers and exhibits from various departments of the college, was run over the Southern Railway and was visited by more than 12,000 people. During 1909 D. N. Barrow, of the department, was transferred to Clemson College as dean of agriculture and director of the college extension and farmers' institute work. The institute work was conducted under the dean of agriculture until a cooperative agreement between Clemson College and the department's farm-demonstration work was effected in 1911, after which all the extension work in the State was under the supervision of the State agent, who was also director of farmers' institutes. In 1908, the farmers' cooperative demonstration work, under Dr. S. A. Knapp in the Bureau of Plant Industry, organized with 1 district agent and 15 county agents. The agents were appointed as collaborators for the Government at $1 per year. The General Education Board of New York paid the remainder of their

salaries. In 1909, the legislature made an appropriation of $5,000 to aid in the demonstration work, and Lewis W. Parker, through the Cotton Manufacturers' Association, appropriated $1,000 for the benefit of the work. Four negro agents were employed this year to work with the negro farmers. The results were very significant this season and caused widespread comment not only in the State, but by observing people from the outside. In 1911, there were 56 agents—50 white and 6 negroes. During this year the college and the department entered into a cooperative arrangement in employing an agent to supervise the club work. In December, 1911, Clemson College and the United States Department of Agriculture arranged a cooperative agreement which was formally signed in January, 1912, for carrying on all extension work. The State agent in the demonstration work also became director of the college extension and institute work. So far as known, this was the first college in the country to enter into cooperative arrangement with the United States Department of Agriculture to carry on its extension work. This year there were 57 men agents, 12 women agents, covering 43 counties, and the college added several specialists to their institute force. In 1913, 51 men county agents were employed and covered nearly all the agricultural counties of the State. On July 1, 1914, the General Education Board funds were entirely replaced by those of the United States Department of Agriculture, and its connection with the extension work terminated. The fiscal year 1914 also marked the beginning of the cooperative work under what is known as the Smith-Lever Act, and the scope of the work was extended along several lines. On June 1, 1914, the governor of South Carolina gave the assent of the State to the Smith-Lever Act and designated Clemson College as the beneficiary of this act, and on July 7, 1914, the representatives of that college signed the memorandum of understanding with the United States Department of Agriculture, providing for the establishment of the division of extension work in the college for the administration of all cooperative extension work in the State.

Organization and administration.—The extension division is organized as a separate department of the college. The staff of workers devote their entire time to extension work. Cooperation is maintained between the college and the States Relations Service, United States Department of Agriculture, in accordance with the Smith-Lever Act and by direct contribution of funds to support the county agent's work. The director cooperates with the dean of agriculture and the director of the experiment station in outlining the policies and principles for conducting the work and as to the correctness of the subject matter used by the agents and specialists

in the field work. The specialists are required to cooperate with the county agents in planning their demonstrations in the counties, and all work must be actual demonstrations. The assistants in charge of the boys' club work and girls' and women's club work are responsible to the director and State agent. All county agents are required to assist in club work.

The present organization consists of the director and State agent, assistant State agent, assistant in charge of boys' club work, assistant in charge of girls' and women's work, three district agents, specialists in animal husbandry, dairying, poultry work, horticulture, and mill-village work, the editor, and the clerical force.

The extension force is called together once a week for conference, and their plans are outlined as far ahead as practicable so that their services may be utilized to the best advantage.

Publications.—There was an editor and publicity man in charge of the printing and distribution of publications. His duties were to edit the manuscripts, attend to printing and mailing of same, and get out material for weekly news letters to be given to the press. The subject matter in these weekly letters was gathered from the field reports of the agents and specialists and also from articles written by members of the extension division, college, and experiment-station staff.

Extension publications were in the form of circular letters, plate material for newspapers, posters, and bulletins. All publications were sent to the lists of demonstrators and cooperators of the county agents, to numerous farmers and business men throughout the State, to the teachers in the State, agricultural colleges of other States, and to the employees of the United States Department of Agriculture. A regular list to be used in this division is being made up.

Thirteen bulletins were issued by the extension division during 1914–15. In addition to these were some other bulletins suggesting farmers' reading courses, and quite a number of circular letters and posters.

Finances.—The sources and amounts of income for extension work in South Carolina in 1914–15 were as follows:

Federal Smith-Lever	$10,000.00
College appropriation	20,290.48
County appropriation	17,401.20
Local community	284.16
Organizations	5,716.55
United States Department of Agriculture, farmers' cooperative demonstration work	43,635.28
United States Department of Agriculture, Bureau of Animal Industry	12,254.26
Total	109,581.93

The Smith-Lever funds were expended in carrying out the following projects: Administration, printing and distribution of publications, county agents' and boys' club work, home-economics and girls' club work, cooperative dairy work, cooperative horticulture, cooperative poultry, and cooperative live stock.

A detailed financial report, showing the expenditure of the above amounts, was submitted and approved.

By an act of the South Carolina Legislature the trustees of Clemson College were authorized to receive money appropriated through the Smith-Lever Act and to pay it out through the college treasurer upon presentation of vouchers properly drawn, indorsed, and signed. All vouchers are made in duplicate and a copy kept in the office of the college treasurer and a copy in the office of the director. These vouchers are numbered and also show the projects to which the money is allotted.

The county agents' salaries are paid partly from the funds of the extension division, the United States Department of Agriculture, and county appropriation or local contributions.

SMITH-LEVER PROJECTS.

County agents' and boys' clubs.—As said before, the director is also State agent. There was an assistant State agent, 3 district agents, a corn-club agent, and 46 county agents. There is an agent in practically every agricultural county of the State. Those working under this project give instructions to farmers and boys on better methods of agriculture and carry out practical demonstrations for farmers on their farms to encourage an interest in agricultural schools, to assist in the organization of farming people for their mutual benefit and to make them more efficient in the handling of the business of the farm. The effectiveness of the work of this organization is easily observed by the wonderful improvement in the agricultural conditions throughout the State in the last five years. A brief summary of some of the results obtained through the agents' work during 1915 follows:

Twenty-six thousand nine hundred and twenty-four tons of fertilizer, home-mixed, at a saving to farmers of $4 per ton; 19,530 acres in corn, averaging 13 bushels above State average; 14,618 demonstration acres in cotton, average 1,437 pounds of seed cotton, as compared with State average of 693 pounds; 7,844 tons of fertilizer bought cooperatively at saving to farmers of $3 per ton; 7,323 hogs treated for cholera; 72 silos built; 55,486 fruit trees pruned and sprayed. The work with these items alone resulted in a great saving to farmers and a material addition to the resources of the State.

Among some other results of the agents were 537 pastures started; seed selected by 2,939 farmers; 465 head of pure-bred horses imported for farmers; 90 per cent of farmers working with agents raised and killed their own meat. There were 24,164 acres in oats sown by demonstrators; 272 canning outfits bought; 347 schools teaching agriculture; flytraps installed by 1,016 people; 171,722 acres fall plowed through influence of agents; 71.1 per cent of demonstrators shallow cultivated, and 85 per cent of demonstrators' farms were terraced and drained.

Boys' clubs.—Prior to April, 1915, there was no supervisor of boys' club work in South Carolina. Such club work as they had was done through the regular demonstration agents. There was little organization among the boys up to this time. As soon as a supervising agent was appointed he began to organize the boys and soon had corn clubs in 41 out of the 44 counties, with a membership of 1,069 enrolled, 466 of whom made complete reports. The average yield of all the boys reporting was 47¼ bushels per acre, at a cost of 42½ cents per bushel; 49 boys averaged 89 bushels, at a cost of 27½ cents per bushel; 8 boys produced an average of 116 bushels, at a cost of 15 cents a bushel; and one boy produced 164½ bushels, at a cost of 9 cents a bushel. This was a remarkable record, considering the soil, amount of fertilizer used, and the season.

The boys' club work was greatly stimulated as the result of a short course held at Clemson College from August 9 to September 4. The board of trustees had offered two scholarships in each county of the State, to be awarded to the boys making first and second records according to rules laid down in circular No. A–74. Seventy-eight boys from 39 counties, having won the scholarships, reported on the opening day; 75 completed the course and received certificates signed by the president of the college and the director of extension.

At 19 of the county fairs there were boys' club departments in the exhibits. At the State fair 226 exhibits of corn were received from the boys throughout the State.

The boys' pig-club project was added to the boys' club work in the State in the spring of 1915. The organization was completed in 11 counties, with a membership of 245, 88 of whom rendered reports.

Home demonstrations and girls' clubs.—This work is cooperative and in accordance with the general memorandum of understanding with Clemson College and the Department of Agriculture, signed July 7, 1914, is carried on in cooperation with Winthrop College through Clemson College. The supervising agents in women's and girls' work have headquarters at Winthrop College, South Carolina. The policies and plans for carrying on the work are approved by the president of Winthrop College, the director of extension, the president of Clemson College, and the chief of the office of extension

work in the South, States Relations Service, United States Department of Agriculture.

Under this project there was a State agent in charge, and an assistant with 26 county agents employed for nine months. In 1915–16, this time will be extended to 10 months. The enrollment of club members for 1915 was 5,426. Of this number 1,250 did bread demonstration work, 1,440 canning, and 763 poultry work; 1,973 women were enrolled in home-demonstration work; and 1,206 girls were instructed in sewing. Among other interesting results may be mentioned 48 county meetings and 1,440 community meetings held by these agents; 336,669 cans and jars of products put up by the clubs. The total estimated value was about $42,393.69. Winthrop and Coker Colleges gave short courses of 10 days each, and 3-day short courses were held in 8 counties, with a total attendance of 1,210 women and girls. They were given a course in cooking, sewing, gardening, poultry raising, and dairying. Ninety-seven rural schools were equipped with simple domestic-science outfits. County superintendents of education, school-improvement associations, women's clubs, and generous merchants helped to place these outfits. Through the influence of these agents 840 fireless cookers, 216 iceless refrigerators, 72 wheel trays, and 360 flytraps were made; 216 houses screened; 11 home waterworks installed; 520 cleaning devices, 72 kitchen cabinets and 2,697 canning outfits placed in homes and instruction given as to better arrangements of the kitchen, protection of the homes against flies, and other sanitary devices.

One of the difficulties that has been found in the canning-club work is the marketing of the products. This was partially solved by having a market day at the county fair, where orders were taken for the canned goods. Agents also interested themselves in introducing the goods to business concerns who desired them. A number of merchants agreed to handle the 4-H brand goods in their stores. The excellent quality is becoming known and it is anticipated that there will be very little trouble in disposing of all that will be produced in the future.

Animal husbandry.—Under this head comes cooperative work carried on in connection with the Bureau of Animal Industry of the United States Department of Agriculture and the college extension division. Five specialists, two for animal husbandry, two for dairy husbandry, and one for poultry, conducted the work of this division. The animal-husbandry line consisted in organizing live-stock associations, visiting the farmers and instructing them as to permanent pastures, the kind of live stock to select, and encouraging the cooperative feeding and marketing of cattle. The main work of these specialists was to assist the county agent and supplement his work along the live-stock lines. Some of the concrete results of the live-stock specialists

were the bringing in of 65 head of breeding stock, valued at $10,000; 125 live-stock meetings held among the farmers with an average of 75 in attendance; 2 circulars prepared and distributed, one outlining forage-crop rotation for hogs and the building and equipment for starting into the hog business in a limited way, and the other comparing the value of mares and mules to the farmer as an investment.

The most important thing was the working up of a plan for cooperative feeding and marketing of cattle. This plan reduces the work to an actual demonstration. A number of farmers were selected who had a small number of cattle to feed—from 1 to 5 each—and after they were fed under the instruction of the county agent and specialist in charge, central points were designated where the cattle could be collected, and there buyers from different points met to bid for them. This was the means of showing the farmers the types of stock that were the most profitable to handle. Definite instructions on feeding, handling, and dehorning beef cattle and on conserving farm manure were given to the farmers. While this experiment was not completed in 1914, the 1915 records show that it was not only a success but proved profitable to the farmers.

Dairying.—Two specialists had charge of the dairy work under this general project. They furnished information to county agents and to the farmers as to dairying, creameries, etc. Considerable effort and time were given to cooperative creamery work. The one established at Clemson College has proven quite a success, the output having gradually increased from 500 pounds of butter in September, 1914, to 19,000 pounds in June, 1915. Many successful cream routes have been established since this project has been begun. The men who gather the cream on these routes are also collecting the eggs from the different farms and bringing them into the creamery, where they are classified and marketed in a cooperative way.

Poultry.—The poultry-extension work was also included in the live-stock project. The specialist in charge spent the greater part of his time in assisting agents and instructing the farmers and in organizing the work. His advice was in demand by those who were in the commercial poultry business and also by those farmers who were planning to make this a side line in their farm operations. Considerable time was spent in speaking on this subject in institutes. Charts and live specimens were used in these talks for illustrative purposes. The specialist has worked out a formula for a mixed poultry feed, which is apparently giving satisfaction. No poultry clubs were organized during 1914–15, but it was planned to begin definite organization work in 1915–16.

Horticulture.—There was one agent employed under this project, whose duty it was to assist the county agents and the farmers along

horticultural lines, also to conduct practical demonstrations in pruning and spraying of trees, standardizing and packing of fruit. In 1914–15 this specialist took charge of the treatment of several orchards (totaling something over 5,000 trees) to demonstrate the value of proper pruning and spraying. Under his supervision also were started several new orchards, comprising about 2,500 trees. Under his instruction and that of the county agent home orchards were started in nearly every county in the State—from two to five in each.

Another feature of the work was to interest people in cooperative canneries. Definite work along this line has been done in Saluda, Marlboro, and Calhoun Counties.

OTHER EXTENSION WORK.

Mill-village work.—A line of work not financed by the Smith-Lever funds is the mill-village work. The object of this work is to instruct girls and the youth in mill villages in the principles of successful home gardening, canning, poultry raising, etc. This work is a combination of club and demonstration work with civic improvements, athletics, etc. Tomato clubs are the basis of this work. The boys and girls of the mill villages are taught to grow and can tomatoes; adults are organized into garden clubs; and prizes are given for the most beautiful yards. Sanitation, tree planting, athletics, flower yards, and winter and summer gardens are all encouraged.

This work was begun as an experiment by placing an agent with the Monigan mills at Greenville, S. C., in 1911. After two years at Greenville the agent was transferred to Rock Hill, S. C., and work begun with two mills at that place. In 1914–15 the work was carried on in 19 mills in various parts of the State, with a total enrollment of 1,000 members in the clubs. The supervisors' salaries were paid by the department and Winthrop College. In 1913 one mill employed a local supervisor for the mill-village work. In 1914 there were 11 local supervisors, whose entire salaries were paid by the mill owners.

A brief summary of what was done in 1914–15 is as follows: Nineteen mills engaged in the work; 11 local demonstrators; 746 enrolled in tomato clubs; $211.50 offered in cash prizes; 1 scholarship to Clemson College; 1 scholarship to Furman University; 54,181 pounds of tomatoes raised; 479,000 plants raised and distributed by local demonstrators; 2 mill-village fairs held, with total attendance of 5,000; 40,000 hardy shrubs, grapes, etc., grown; 30 public canning demonstrations given.

OUTLOOK.

The outlook for extension work in South Carolina is distinctly encouraging. The cooperative arrangements seem to be satisfactory. The growing demand for county agents' assistance and the increasing calls for help of specialists denotes the appreciation of the services of the extension division. The director and the entire force of the extension division are bending all their energies to serve all the agricultural interests of the State.

TENNESSEE.

Division of Extension, College of Agriculture, University of Tennessee, *Knoxville.*

C. A. KEFFER, *Director.*

History.—There is no authentic record of when the first movement for agricultural development in Tennessee was begun. An agricultural and mechanical society was established in Shelby County in 1856 by an act of the legislature. County fairs have been held, with more or less success, since that date. The first agricultural bureau, known as the Office of the Commissioner of Agriculture, was created by an act of the legislature in December, 1871. An appropriation for holding institutes was made by this bureau in 1899. While no definite policy of conducting institutes was followed, the funds have been used by the commissioner of agriculture for this purpose since that time. The college of agriculture of the University of Tennessee has cooperated with the commissioner of agriculture by furnishing speakers.

An agricultural train was run in 1911, which contained a carload of exhibits of live stock and illustrative material for use of the instructors while delivering the institute lectures. This campaign was what is now known as short-course work. These institutes or short courses were usually held at the county seat, and local funds were guaranteed to cover actual expenses.

Since 1915 movable schools of agriculture have been conducted by the division of extension and the college of agriculture, and these have taken the place of farmers' institute work, formerly carried on by the commissioner of agriculture.

The East Tennessee Farmers' Convention was organized in 1872 and has held annual sessions since. The West Tennessee Experiment Station was established at Jackson in 1909 by State appropriations as a part of the Tennessee Experiment Station established by the United States Government funds. The college of agriculture of the University of Tennessee was organized in 1869 under the Morrill Act of 1862. The experiment farm was established in connection with

the college in 1870. The experiment station, under the Hatch Act, was organized in 1887.

The first short course in agriculture was offered by the college in 1886, and covered a two months' period. Since 1900, the college of agriculture has conducted a short course during the months of January and February at the university at Knoxville. The college has conducted short courses of one week's duration each in various other places in the State since 1909. The approximate attendance at the courses has been more than 6,000. Since its establishment, July 1, 1914, the division of extension has had charge of all short courses in agriculture except those which were held at the university, which were under the care of the college.

The farmers' cooperative demonstration work of the Bureau of Plant Industry, United States Department of Agriculture, was established in Tennessee in the fall of 1910. The work was primarily intended for the cotton section, and for this reason was at first confined to the western part of the State.

At the beginning of 1911 there was a State agent, 1 district agent, and 8 county agents. In 1912, the number of county agents was increased to 16 (with an additional district agent), and to 23 in 1913. Some work was extended to the middle and eastern part of the State. The entire force, consisting of the State agent, assistant State agent in canning-club work, 2 district agents, 22 county agents, 4 agents working in groups of counties, and 22 women county agents were merged with the extension division of the college on July 1, 1914.

The division of extension was established under the Smith-Lever Agricultural Extension Act, and approved May 8, 1914. The governor of Tennessee assented to the provisions of this act on May 28, 1914, and the legislature assented January 29, 1915.

Organization and administration.—The division of extension is a department of the college of agriculture coequal with the experiment station, working under the direction of the dean of the college of agriculture. Cooperation is maintained between the college and the States Relations Service, United States Department of Agriculture, not only in accordance with the terms of the Smith-Lever Act but by direct contribution of funds in support of county agents' work.

The division of extension occupies the first floor of Carrick Hall, located on the college campus, and has nine well-equipped offices.

The director has charge of all the extension work in the State. Under him is the assistant director who has special charge of the county-agent work, the assistant director in home economics, and three district agents. There are also specialists in agronomy, animal-husbandry, dairy, and poultry work.

A meeting of all the administrative officers and specialists is called at least once a month, at which plans, policies, and other matters of interest are discussed and itineraries outlined for the following month.

Cooperating agencies.—In planning the work of the division of extension an effort was made to bring into close relation all agencies interested in the development of agriculture and in the improvement of all conditions affecting life on the farm. It was felt that the problems to be solved were largely educational, and from the first an effort was made to find a basis of cooperation with the public-school system of the State. The State department of agriculture, under existing law, had for many years conducted farmers' institutes, and it was believed that the purpose of this work, being purely educational, could be achieved to better advantage in cooperation with the division of extension. The railroads of the State had, through their land and industrial departments, conducted demonstrations and disseminated information pertaining to agriculture. These agencies operate in all parts of the State. In addition to these, the division of extension has had the cooperation and financial support of county courts, county school boards, chambers of commerce, and other organizations of business men, banks, and individual citizens.

The division of extension has the advice and assistance of the professors in the college of agriculture, and by frequent conferences its officers endeavor to have their work harmonize in all respects with the teachings of the college of agriculture and the experiment station, and in this they have the cordial cooperation of the entire staff of the institution. The county agents have established cordial relations with the agricultural high schools, and it is believed that the work of the agents and the work of the rural schools will soon reach a working basis by which each will supplement the other. It is gratifying to record the active cooperation which the division of extension has had from all of the agencies above named.

Publications.—In 1914–15 plate matter, consisting of articles prepared by the specialists of the extension division and members of the college and station staff, was supplied monthly to 100 county newspapers in Tennessee.

Seven bulletins were published by the division of extension during the year. Four were especially prepared for use in the women's and girls' work and were distributed largely through the women agents. The others were for general distribution to the list of farmers working with the county agents and other farmers and business men in the State who asked for information contained therein.

Finances.—The following were the sources and amounts of income of extension work in Tennessee for the year 1914–15:

Federal Smith-Lever	$10,000.00
College	6,895.07
State	1,715.04
County	28,882.13
Local organizations	1,754.29
United States Department of Agriculture, farmers' cooperative demonstration work	40,000.00
United States Department of Agriculture, Bureau of Animal Industry	6,149.70
Total	95,396.23

The Smith-Lever funds were used in carrying out the following projects: Administration, printing and distribution of publications, county agents' work, dairying in tick-free territory, movable schools and farmers' short courses, poultry-club work, girls' club work, agronomy, dairying, animal husbandry, and travel (contingent fund).

A detailed financial statement, showing the expenditures of these funds, was submitted and approved.

By an act of the Tennessee General Assembly, the trustees of the University of Tennessee were authorized to receive all appropriations under the Smith-Lever Act and pay them out through the treasurer upon presentation of vouchers that are properly drawn, indorsed, and signed. The vouchers are made out in duplicate and copies kept on file in the office of the college treasurer and in the director's office.

The county agents in Tennessee, both men and women, are paid partly from funds raised within the county and partly from the division of extension and United States Department of Agriculture funds. The extension and department funds are limited to $500 per county with one agent.

SMITH-LEVER PROJECTS.

County agents and boys' clubs.—When the division of extension was organized the county agents' work was recognized as the fundamental part of it. The Federal farmers' cooperative demonstration work was already well organized in 20 counties and partly in a numbers of others. This was taken as a basis upon which to extend the field operations of the division. During the year ending June 30, 1915, the work had been extended to cover 31 counties in men's work and 22 counties in home economics and canning-club work. The county agents' work will be extended as rapidly as funds and conditions will permit. The agents are expected and required to render aid in every phase of farm life, but the idea of having a limited number of concrete demonstrations scattered over the county is still maintained.

A few of the most striking results for 1915 are given as follows: Two hundred and thirteen cotton demonstrations, with 2,218 acres, yielding 1,029 pounds seed cotton per acre, or a net increase over the old methods on near-by lands of nearly 409 pounds; 16,442 acres of corn with average yield of 41.76 bushels, or an increase of 14.43 bushels over the State's average yield. In addition to these two leading crops, 560 demonstrations, embracing 6,589 acres, were conducted with wheat, potatoes, clovers, cowpeas, sorghum, alfalfa, grasses, etc. A campaign for saving crimson-clover seed was pushed and a number of strippers were made, and most of the seed sown in the chaff has done well. Some seed were cleaned and sold for $7 per bushel. One 5-acre field of crimson clover pastured 11 mules, 2 cows, and 20 pigs from November 1 to December 12, and still 33½ bushels cleaned seed and enough in "chaff" to plant 30 acres, and 5½ tons of straw hay were harvested. The agents did much with aid of the specialists to build up interest in live stock; 685 silos were constructed in the State under their influence.

All agents are required to give a certain amount of attention to the boys' corn-club work. A system of organizing these clubs on a community basis is being worked out, and instead of prizes to individual boys as has been the custom, the prizes are offered to groups or clubs. This community club arrangement makes it easier for the teachers in the schools to cooperate. Eleven counties were organized on a community basis in 1915. The awarding of prizes, the measuring of the land, and the selection of the crop is left to a committee composed of the local teacher and a farmer in cooperation with the officers of the club, the county superintendent of education, and the county demonstration agent. The club members are instructed in a body at field meetings held on one of the boys' plats or one of the demonstration farms.

Corn-club work was carried on in 25 counties, with total enrollment of 1,011—509 made complete reports. The average yield of corn was 50.89 bushels per acre, at a cost of 36.6 cents. Eleven counties were organized on a community plan with a total of 45 clubs. The average number of boys in these community clubs was 10.9.

Girls' clubs.—The canning-club work was very successfully conducted with 2,763 girls enrolled in 26 counties; 151 county meetings and 1,171 community meetings were held with total attendance of 48,891. The girls put up a total of 228,208 jars and cans of fruits and vegetables. Those with one-tenth-acre demonstrations averaged $24.05 profit on their plats. In addition to the girls' club work, 209 women demonstrators were enrolled. Aside from instructions in canning and gardening work with women and girls, dairying, bread making, cooking, and household sanitation received attention.

Numerous household and kitchen conveniences, such as fireless cookers, fly traps, wheel trays, etc., were made by club members under the direction of the women agents. Prizes to the amount of $2,337 were given to the girls in the club during the year.

Animal husbandry.—Besides the cooperative work done with the county agents in animal husbandry, a specialist collected data for a breeders' directory for the State. A number of farmers over the State were assisted in selecting pure-bred breeding stock. Plans for building barns, silos, and other farm buildings were drawn and sent out. A bulletin was written by the specialist in animal husbandry on "Feeding Cottonseed Meal to Work Stock." A number of feeding demonstrations were conducted under his supervision.

Dairying.—The specialist in dairying cooperated with the county agents in establishing cooperative creameries and cream routes, planning of dairy barns, and purchasing good dairy cattle. He also did some work in assisting farmers to start records for testing out herds in counties where one or two were located. In counties where there were no agents the specialist visited individual farmers upon request.

Poultry.—The specialist in poultry work confined his activities principally to six counties and with the women agents. In these counties poultry clubs were organized and definite instruction given in the proper handling, housing, classifying, and marketing of the products. A part of the specialist's time was utilized in short-course work out from the college. He also attended a number of field meetings with the district and county agents in men's work and gave instruction and information on keeping and caring for the farm poultry.

Agronomy.—The agronomy specialist, besides assisting the agents and individuals with various problems in his line, prepared plans for school-demonstration work in the counties where agricultural high-school boards were cooperating. He also prepared a chart giving a forage-crop system for hogs, especially applicable to Tennessee conditions, for the use of the agents. Twelve successful demonstrations were carried out with agents in eight counties. Some cooperative demonstrations in the use of ground limestone were carried out in five counties in western Tennessee. A number of field demonstrations were conducted by the agronomist on breaking land by the use of the subsoil plow and the disk harrow. He also personally supervised the distribution of an improved strain of beardless barley, originated by the Tennessee Experiment Station.

Movable schools.—Movable schools were conducted largely by the specialists and other members of the extension staff in communities that called for these schools.

OUTLOOK.

The general outlook for extension work in the State is distinctly encouraging. An effort will be made gradually to broaden the scope of the work. It is already apparent that not only the work of the division of extension, but all agricultural interests as well, will be greatly promoted by community organization, and an effort will be made to develop the work of the division more and more on the community basis. Recognizing the great diversity of agricultural interests and opportunities in Tennessee, it is proposed to conduct the demonstration work in each county on a separate plan, which shall be especially adapted to the needs of the county.

TEXAS.

Division of Extension Service, Agricultural and Mechanical College of Texas, *College Station.*

CLARENCE OUSLEY, *Director.*

History.—The earliest mentioned agricultural or field extension work in Texas was in 1892, when an agricultural journal, published in Dallas, took an active part in holding a series of farmers' institutes in cooperation with the railroads and some of the staff of the agricultural and mechanical college and experiment station. The interest created resulted in an appeal to the legislature for financial support, but this body failed to render aid at this time.

In 1897, the Farmers' Congress, a State organization, passed a resolution advocating farmers' institutes as a means of disseminating scientific knowledge of the art of agriculture. No very definite results were obtained from these appeals. About 1902, the same agricultural journal mentioned above organized some institute work, and at its own expense provided a State organizer, who, with the assistance of the public, the railroads, and members of the agricultural forces at the college, conducted a series of institutes throughout the autumn and winter. These meetings created such favorable attention that the legislature in 1903 made a small appropriation for two years' support, and a member of the college faculty was appointed director. A certain number of institutes were held yearly afterwards. County organizations were gradually formed under the constitution and by-laws suggested by the director.

The legislature failed to keep up the yearly appropriations, but the college provided for the director's expenses and depended on private contributions from individuals, railroads, and the agricultural press of the State to continue its institute work. In some instances assistance was rendered by the Federal Department of Agriculture in the early campaign for diversification following the boll-weevil infestation.

These county organizations agreed to meet once a month to discuss agricultural problems, and round-up institutes were held yearly at the college, with a fairly good attendance.

In 1907, the State department of agriculture was organized with a commissioner in charge. The work of this department is largely regulatory, but its general functions are to encourage horticulture, agriculture, and kindred industries. It also issues publications in the shape of bulletins for disseminating agricultural information among the farmers of the State.

In an act approved April 17, 1871, the legislature provided for the establishment of the agricultural and mechanical college. The constitutional convention of 1876 designated the college as a branch of the University of Texas and selected a location for same in Brazos County. The college was opened for teaching on October 4, 1876.

The experiment station was organized June 25, 1888, as a part of the agricultural and mechanical college. Except for the participation in the farmers' institutes mentioned above by the workers of the college and experiment station, there was little organized extension work until 1910, when the board of directors provided for an extension department in the agricultural and mechanical college, which confined its activities principally to correspondence courses, short courses in the college, demonstration trains, and a few movable schools, or short courses over the State, and also took some part in organizing the boys' and girls' clubs.

At a meeting of the board of directors in 1912, Mr. R. L. Bennett introduced a resolution to create a regular extension service in the college. Under this resolution a committee to outline and direct the work of the service was appointed, composed of the dean of the school of agriculture, the dean of the school of engineering, the State chemist, and the director of the experiment station. Lack of funds prevented specific work in addition to that already mentioned until July, 1913, when the board of directors provided an expense fund for salaries to conduct a limited amount of extension work for 1913–14 and 1914–15.

The farmers' cooperative demonstration work, Bureau of Plant Industry, United States Department of Agriculture, was begun in a small way in Texas in 1904. For the first four years the work was conducted by a few agents covering a large territory. Each agent established a limited number of demonstration farms along the railroad lines in his territory. The first time county agents were appointed to devote their entire time to a single county was about 1908. This plan proved very satisfactory. The demand for local or county agents increased, and they were supplied as rapidly as funds could be obtained. The first local aid for the support of the county agents'

work was contributed about this time by business organizations within the State. In the early period of demonstration work in Texas the agents worked from seven to nine months. In the last few years practically all of them are working full time.

The farmers' cooperative demonstration work continued its operations as an independent organization, except occasionally to assist the other forces in the State to hold public meetings and render assistance in a general way, until March 6, 1912, when a memorandum of understanding was signed by the president of the college and the Chief of the Bureau of Plant Industry for cooperative extension and club work, and three cooperative agents were appointed, a part of whose salaries was to be paid by the college and a part by the department. This memorandum was superseded by another agreement, signed by the same parties, effective October 1, 1912, making all the extension work of the college and the department cooperative and the State agent and other supervising members of the demonstration force members of the faculty of the college. With this understanding the State agent's headquarters were moved to the college, where he was furnished with suitable quarters and sufficient clerical help. This arrangement was continued until July 1, 1914, when the Smith-Lever Act of May 8, 1914, became operative. The governor of the State gave his assent to this act on June 27, 1914, and the legislature approved it January 29, 1915.

Organization and administration.—The extension service was organized as an integral part of the Agricultural and Mechanical College of Texas, and ranks with the school of agriculture, the school of engineering, and the experiment station as a coordinate department of the college. The extension service is planned and conducted upon the advice of an extension committee, consisting of the director as chairman, the deans of the college, and the director of the experiment station. The specialists in the extension division are required to maintain an intimate relation with corresponding heads in the college and experiment station, in order that the subject matter used in their field work may be in harmony. All the extension work is under the immediate supervision of the director. There is a cordial relationship with the State department of agriculture and the State department of public instruction and some practical cooperation with each in certain definite undertakings. The extension division renders such service as is practical to other State institutions of learning and commercial and farmers' organizations throughout the State.

It is contemplated in the extension division for all the staff to devote their entire time to extension work. The members of the staff have the same rank as college professors.

The extension department is housed in Garthright Hall on the agricultural and mechanical college campus. There is sufficient room,

but the arrangement is not what it should be to promote the greatest convenience and efficiency. The office equipment is ample, and there is a fair supply of charts and supplies for use in the movable schools and lecture work.

Publications.—Publications of the extension division are in the form of circulars and bulletins, of which there were seven during 1914–15, on the following subjects: Money Crops in the Place of Cotton, Peas and Peanuts, Cotton Crop Mortgage Credit, Sweet Potatoes for Profit, Value of Cotton, The Dairy Cow, and Successful Marketing. The number issued of each publication was governed by the apparent demand for same. The publications were prepared by members of the extension, experiment-station, and college staffs.

There was a general mailing list, numbering about 10,000, consisting of organized groups of farmers and individuals who have asked for all publications. There were other special lists to whom certain bulletins are sent. Any bulletins that were available on special subjects were sent to organizations and individuals upon request.

Finances.—Funds for the extension work in Texas in the year 1914–15 were derived from the following sources:

Federal Smith-Lever	$10,000.00
College appropriation	13,581.21
State appropriation	17,473.79
County appropriation	76,097.16
United States Department of Agriculture, farmers' cooperative demonstration work	72,402.89
United States Department of Agriculture, Bureau of Animal Industry	6,447.00
Total	196,002.05

The Smith-Lever funds were used in carrying out the following projects: Administration, printing and distribution of publications, county agents, home economics, movable schools, boys' club work, and rural highways.

A detailed financial report, showing the expenditures of these funds, was submitted and approved, this statement showing a Smith-Lever balance of $20.82.

An act of the legislature, approved January 29, 1915, authorized the treasurer of the Agricultural and Mechanical College of Texas, or such other fiscal agency as may be directed by the directors of the said college, to receive the grants of money appropriated under said act. The board of directors of the agricultural and mechanical college authorized the business manager of the college to receive such appropriations and disburse them under the proper warrants as are provided for the funds of the college. The Federal Smith-Lever funds are kept in the office of the State treasurer and paid to the

business manager of the college on monthly vouchers supported by receipts. Duplicate vouchers are kept; one copy in the office of the business manager and one in the State treasurer's office. All vouchers must be properly drawn, indorsed, and signed, and also show the projects to which the money is allotted.

County agents in Texas, both men and women, are paid partly from funds raised within the counties, partly from the Smith-Lever fund, and partly from the United States Department of Agriculture.

SMITH-LEVER PROJECTS.

County agents.—The county-agent demonstration work is conducted by the State agent, 6 district agents, and 82 county agents. The county agents are the chief instruments of the extension activities of the college and Department of Agriculture.

Among the notable achievements of the agents during the past year, besides the work in farm demonstrations and promoting diversification, may be enumerated the following: The growing and storing of sweet potatoes, as a result of which it is estimated that a million bushels were put into houses for gradual marketing; an increase in the peanut crop and the crushing of peanuts by a dozen or more oil mills; the purchase of pure-bred live stock for breeding—24 stallions, 22 jacks, 91 brood mares, 162 bulls, 848 cows and heifers, 1,631 boars, 1,977 gilts and sows, besides a large number of grades for breeding purposes; 1,125 hog herds started; 99 poultry demonstrations; 963 farms improved; 181 dipping vats erected; 368,141 head of cattle dipped; 21,549 cattle treated for blackleg; 17,510 animals treated for charbon; 38,773 cattle treated for ticks, 15,112 hogs treated for hog cholera; 14,153 farmers instructed in the use of fertilizers; 198 fertilizer demonstrations; 172 tons of fertilizer bought cooperatively; 3,900 farmers instructed in the use of manure; 643 manure sheds built; 184 manure spreaders bought; cover crops—1,045 acres barley, 4,955 acres oats, 3,083 acres rye, 751 acres wheat; 599 orchards inspected, 73,246 trees inspected; 289 farm buildings erected; 698 farm buildings painted; 221 water systems installed; 347 silos built; 460 silos caused to be built; 654 pastures established; 189 pastures renovated; 811 farms terraced, with an acreage of 56,486; 205 farmers' organizations promoted, with a membership of 7,955; 21,589 visits to farm demonstrators; 14,199 visits to farm cooperators; 4,991 visits to other farmers and business men; 12,225 visits to club members; 1,820 general meetings, with an attendance of 13,538; 726 field meetings, with an attendance of 5,539; 62,272 railway miles traveled; 203,561 team miles traveled; and 163,101 bulletins distributed.

Girls' clubs and home economics.—This service was conducted by a State leader, 1 assistant, 2 temporary district agents, and 32 women

county agents in the main division of what is generally known as the girls' canning-club work. There was another division conducted by one leader and one assistant, consisting of the organization of rural women for the study and practice of home economics. The number of girls enrolled in the 32 counties was 6,336. Total number of cans put up, 53,068; total number of glass jars and other containers, 26,936. The largest net profit by a single girl was $242 on 1,730 cans of tomatoes and peaches and 200 glass jars of berries and other products. The largest yield by a girl on a tenth acre of tomatoes was 6,845 pounds. Under the direction of the county agent 4,730 dozen eggs were marketed through nine egg circles in Dallas County from May 1 to October 30. Similar results, though on not so large a scale, could be reported from nearly every one of the other counties.

This work began with the tomato alone as a means to an end. Its ultimate object was to interest the rural housewife by first interesting her daughter. From the canning-club work the service has expanded and now includes instruction in dressmaking, housekeeping, poultry raising, home dairying, butter making, etc.

Equal success has attended the inauguration of the organization of rural women into clubs for the study and practice of home economics. This work was inaugurated in Texas early in 1915 and numbers 105 clubs who were provided with well-arranged reading courses and who were visited periodically by lecturers and demonstrators who are attached to the staff. Instruction is given in gardening, orcharding, poultry keeping, and dairying in so far as they relate to the family maintenance.

Boys' clubs.—This service was conducted under a State leader through the district agents and the county agents of the farm-demonstration work. There was one general agent who promoted agricultural clubs and one who promoted live-stock clubs. The live-stock club was not specialized until the latter part of the year and, therefore, is just now fairly under way. The enrollment of members takes place early in the year. The boys enrolled in club work in 1915 numbered 7,028, classified as follows: Corn, 3,312; grain sorghums, 1,112; peanuts, 853; cotton, 471; pigs, 1,068; calves, 212.

The pig and calf clubs' enrollment for 1916 promises to be nearly as large as the enrollment in agricultural clubs. As evidence of the value of this work to the rising generation, it may be recorded that the average yield of corn by club boys was 35.6 bushels to the acre, while the average number of bushels by farmers in the same neighborhood was 24.7. The average yield of seed cotton per acre by the boys was 1,178 pounds, compared with 759 pounds by the farmers in the same neighborhood. The average profit of the boys on a

single hog was $7.73, and the average profit on a baby beef was $26.18.

Movable schools.—Forty movable schools of three days' duration each were held from June until September. Twenty were held in the fall and winter months. The average attendance at these schools was about 100. In addition to these three-day schools, a number of one-day schools were held at various places. During the season for conducting these schools practically the entire specialist force was divided up into groups of from three to five persons and sent out to different places. Great care was exercised in sending to a place persons who were qualified to take up the problems in which the people of the locality were most interested. Usually the procedure is to take the morning session for lecture work and the afternoon session for actual demonstrations. These schools are divided into two sections—one for the men and one for the women. Every effort is made to make each of these schools literally and truly a practical school of demonstration. The specialist force used in these movable schools utilize the remainder of their time for practical demonstration work in the field with the agents and the people on the farms.

One interesting thing done in connection with these schools was what was termed an orchard clean-up campaign, in which the State department of agriculture rendered valuable assistance. Spraying and pruning demonstrations were carried on in four to six orchards a day, mostly in the fruit sections of the State, for a period of two months.

Rural-highway work.—The work under this project consisted of advice to farmers and county authorities relating to the effect of good rural highways upon the economy of agriculture, inasmuch as the cost of transportation of the farmers' products to the primary market is a very important item of expense. The specialists in this field also incidentally gave attention (on call) to rural-highway projects and conferred with county authorities as to available material.

OTHER EXTENSION WORK.

Rural engineering.—This service consisted of general advice and demonstrations in the terracing of lands, drainage, and advice on the construction of farm buildings, etc. As noted in the agents' work, 811 farms, with a total acreage of 56,486, were terraced by the county agents. The county agents worked under the direction of the expert engineer attached to the staff. In addition to working with the agents, he gave demonstrations in counties where there were no agents. He drew and distributed plans for economical farm buildings, for which there is a growing demand.

Farm management and rural credits.—This work started primarily in the organization of diversification and marketing associations in

the fall of 1914, during the cotton panic. More than 100 such associations were organized, and the majority of them did more or less practical work in group marketing. Following that campaign, early in 1915, special attention was given to typical groups of farmers in different sections of the State to develop methods of marketing the local surplus products in the most practical and economical manner.

One of the most important undertakings of this division conducted in 1915, and still continued, was maintained in cooperation with the State Bankers' Association, on the need of establishing food-and-feed farming as a safer basis of credit than all-cotton farming. About 100 banks in the cotton belt of Texas are now basing their credits to farmers more or less rigidly upon the condition of food-and-feed farming as distinguished from all-cotton farming. The consequence is greater diversification, and the results are that the farmers are more self-supporting than they have ever been in the cotton section.

Rural organizations.—This division had a direct relation to the farm-management division and was really a part of it. The men employed in this service gave themselves especially to promoting and maintaining organized efforts. As a result of their services 250 groups were organized with a total membership of a little more than 10,000.

Negro extension.—While negroes had access to all the service of the department, it was felt that on account of racial and social distinction we should render them some special service through their own people. Therefore, at the beginning of the fiscal year 1915 three negroes were employed, two men and one woman, who gave their time very successfully to the same kind of work that is done with white farmers and their families. The negro workers have proved themselves very efficient. The negro leaders of the State have given great assistance, and the people are responding satisfactorily to the instruction given. As far as possible, the work for negroes is affiliated with the Prairie View State Normal and Industrial College.

Creamery extension.—This work was conducted in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, and the special agent in charge of it gave particular consideration to the creameries of the State, and advised them in all the expert matters in the manufacture of butter. In addition, he visited the county agents and groups of farmers who were concerned especially in the sale of butterfat to the creameries.

Dairy-husbandry extension.—This is intimately related to the creamery extension work. The service was conducted by a general agent who worked in intimate cooperation with the creamery agent. He was especially concerned in the problems of producing milk. Besides doing the general work of a dairy expert and assisting in

the movable school work, he gave direct assistance to the creamery expert in the creamery demonstrations already cited.

OUTLOOK.

The extension division in Texas is apparently adjusting the work in a satisfactory manner. The appreciation of the work of the county agents and entire service seems to be growing among the farmers. The energies of the entire extension division are being directed to maintain the good start made in bringing about a more general adoption of safe farming methods. The important part of the work has been, and probably will be, the attacking of some broad, economic problems of the people of the State, such as a better and safer system of farming, proper diversification and marketing.

VIRGINIA.

Division of Extension Work, Virginia Polytechnic Institute, *Blacksburg.*

J. D. Eggleston, *Acting Director.*
[J. M. Jones, appointed July 1, 1916.]

History.—The Agricultural and Mechanical College of Virginia was established in 1872, when the general assembly of that State accepted the congressional grant of 1862. In 1896 the words "and Polytechnic Institute" were added to the title of the college for the purpose of more clearly defining the scope of its work.

The agricultural experiment station was organized and made a department of the college in October, 1888, in accordance with the act of Congress of 1887.

An act of the State legislature creating "the Department of Agriculture, Mining, and Manufacturing" for the State was put into effect July, 1877, "under the control and management of one officer, * * * known as the Commissioner of Agriculture." Among other things his duties were to prepare a "Hand Book of the State," disseminate information relative to remedies for fruit diseases, encourage horticulture and fruit growing, dairying and sheep raising. He was also permitted to make special reports.

In March, 1888, the general assembly created a board of agriculture, composed of one member from each congressional district, and conferred upon it the power of directing and controlling all expenditures made by the commissioner of agriculture. It also provided for a bureau of immigration and of labor statistics connected with agriculture as a part of the State department of agriculture.

Farmers' institutes seem to have taken definite form, under the direction of the commissioner of agriculture, about the year 1890, although an act providing for them was not enacted until 1893. The

number of these institutes increased gradually, until in 1900 they were held in 17 counties. The new constitution of 1903 appropriated $500 from the revenues of the State board of agriculture to each of its 10 members for the purpose of holding institutes in their respective districts. However, comparatively few such institutes were held.

At a joint meeting of the State board of agriculture and board of control of the Agricultural and Mechanical College and Virginia Polytechnic Institute, held in 1905, a plan of cooperation between the two boards was decided on whereby the members of the experiment station staff were made available as lecturers at farmers' institutes in the State. At first considerable interest was manifested and a number of institutes were held. Later this interest waned, and it seems this method of handling institutes ceased. Farmers' clubs of the State continued to hold institutes, often at their own expense, the college attempting to send at least one man to each of these.

During the year 1907 the Office of Farmers' Cooperative Demonstration Work, United States Department of Agriculture, inaugurated demonstration work in Virginia, through county agents, by the employment of an agent to work one or two counties of the State. During the same year a negro agent, to work with his race, was added. This form of extension has grown, until in 1914–15, 1 State agent, 4 district agents, and 54 county agents were employed; also 15 negro local agents and 1 negro district agent.

Demonstration work was commenced with girls' canning and poultry clubs in June, 1910, when a woman agent was appointed. The interest in this activity increased steadily. In 1914–15, 1 woman State agent, 1 district agent, 20 county agents, and 7 assistants were engaged in the work. A negro woman agent was employed in May, 1913, to commence similar work, organizing negro girls' home-makers' clubs, under the supervision of the State agent of girls' clubs and home-demonstration work. One district agent and 26 supervising industrial teachers, all negro women, acting as agents in their districts, were employed. This work is in cooperation with the superintendent of rural elementary schools of Virginia.

Practically all of the salaries and expenses of the agents engaged in the above activities, prior to July 1, 1914, were financed by the General Education Board of New York. Upon that date its cooperation with the United States Department of Agriculture ceased, and the financing of the work organized was taken over by the department.

In 1908 the general assembly passed an act permitting the State board of education to cooperate with the United States Department of Agriculture in its work through county agents and to appropriate money to aid in demonstration work through boys' clubs.

The legislature of 1910 provided for a united board of agriculture, to act as the cooperating agency of the State for conducting all forms of demonstration work carried on by the United States Department of Agriculture within the State. This arrangement continued until June 30, 1914. At that time the united board of agriculture was dissolved by the general assembly and its duties transferred to the agricultural college, in response to a joint petition of that board and the board of visitors of the college.

From 1908, each biennial session of the legislature increased the annual appropriation for demonstration work, until in the spring of 1914 the sum of $20,000 was reached.

The governor of the State agreed to the provisions of the Smith-Lever Act on May 19, 1914, and designated the Agricultural and Mechanical College and Virginia Polytechnic Institute as the recipient of the funds. On January 29, 1915, the general assembly passed a resolution formally accepting these provisions.

Organization and administration.—There is a director, located at the college, appointed by the board of visitors, who has the supervision of all extension work. Four of the specialists employed are located at the same place. The other specialists and the two State agents have headquarters at other points in the State.

The demonstration work, done through and by county and local men and women agents, is recognized as the fundamental part of the extension service. In any county the agent or agents therein are considered in general charge of the plans for agricultural extension in that county, under the department of extension work, and are expected to correlate the work of specialists and other representatives of that department in the county.

Under date of June 30, 1914, a memorandum of understanding governing extension work in Virginia was drawn and signed by the president of the college and the Secretary of Agriculture.

The college had no organized extension work prior to July 1, 1914, except when it conducted some movable schools during the years 1910 to 1912, for which the legislature had made an appropriation of $5,000.

On that date the extension department was organized, with the president of the college named as acting director.

Relations of the agricultural-extension department to other organizations or agencies.—The extension department has direct connection with the agricultural college and experiment station, not only through the president of the college, who was also acting director of extension work, but through the specialists in animal husbandry and horticulture, who have their offices with those departments.

The extension department of the college cooperates with the State department of agriculture in a campaign of education over the

State, looking toward the control of hog cholera. The department furnishes serum free of cost to the hog-cholera specialist for demonstration purposes, also arranges with county agents for the local handling of serum for the convenience of farmers.

The county agents of the extension department assist the State department of agriculture in advertising farmers' institute trains and other special meetings.

Cooperation of the State department of education with the extension department in the employment of supervising industrial teachers has been referred to in the preceding pages.

Cooperative relations exist between various educational institutions, also boards of supervisors, fair associations, commercial clubs, etc., in the employment of agents to conduct the various lines of demonstration work.

Publications.—Three extension bulletins, totaling 8,000 copies, and nine circulars and posters, totaling 20,100, were published during the year and distributed through county agents and specialists, and a mailing list compiled from the general experiment-station list, from names sent in by county agents and individual inquiries. The contents of these publications were prepared by the various members of the extension force.

Finances.—During the fiscal year ending June 30, 1915, the amounts following were expended from the sources mentioned in extension work in agriculture and home economics:

Smith-Lever funds	$9,997.43
State appropriation	26,661.01
County boards of supervisors	25,470.57
Miscellaneous sources	4,268.10
United States Department of Agriculture, farmers' cooperative demonstration work	38,420.18
United States Department of Agriculture, Bureau of Animal Industry	3,781.00
Total	108,598.29

Smith-Lever funds were expended through the following lines of work: Administration, county agents, girls' canning and home-demonstration work, and specialists in animal husbandry and horticulture.

A detailed financial report, showing the expenditures of these funds, was submitted and approved, this statement showing a Smith-Lever balance of $2.57.

SMITH-LEVER PROJECTS.

County agents.—A State agent is in immediate charge of this project. During the year 1914–15, 4 district agents and 54 county agents, working in 54 of the 100 counties of the State, were employed.

The salaries of these agents are paid jointly by the county boards of supervisors or other local sources, the college of agriculture, from congressional and State appropriations, and the United States Department of Agriculture.

A short summary of the year's work, ending December 31, 1915, follows:

The county agents, in pursuance of their work, traveled 50,754 miles by rail and 172,971 miles by team or other conveyance and made 17,865 visits to demonstrators, 9,637 visits to cooperators, 9,867 visits to other farmers, 3,968 visits to business men, and 6,931 visits to boys' and girls' club members. In addition to this, 3,939 farmers made personal calls on the agents at their offices and homes, and 5,615 called over telephones. Nine hundred and four farmers' meetings were held by the agents, with an approximate attendance of 81,792 persons. These agents also held 424 field meetings with an aggregate attendance of 6,846 persons. An average yield of 51.2 bushels of corn was obtained on 15,895 demonstration acres, or an increase of 19.5 bushels per acre over that grown in the State under ordinary methods. Three hundred and fourteen acres of cotton yielded an average of 1,288.4 pounds of seed cotton, or an increase of 429.2 pounds per acre due to improved methods. Thirteen thousand four hundred and fifty-seven acres of wheat, grown in cooperation with the agent, averaged 23.2 bushels per acre—an increase of 9.9 bushels per acre over that not so grown. Four thousand eight hundred and sixty-four acres of oats averaged 34.9 bushels to the acre, which was an increase of 13.1 bushels per acre. Alfalfa on 6,838 demonstration acres averaged 3.75 tons to the acre, an increase of 1.3 tons per acre. Out of 10,311 acres of crimson clover in demonstrations, 976 were cut for hay, with an average yield of 1.3 tons, or an increase of one-half ton per acre. Of 11,596 acres in clover and mixed grasses, 8,490 were cut for hay and averaged 2.1 tons per acre, an increase of 1.04 tons, or 98.1 per cent. One thousand four hundred and twenty-five acres of vetch and vetch mixtures were cut for hay, out of 3,409 acres in demonstrations, and yielded an average of 1.9 tons per acre, or an increase of 0.8 ton per acre. Of the 4,360 acres in cowpeas, 2,555 were cut for hay, averaging 1.8 tons per acre, or an increase of 0.8 ton per acre. In soy beans, 434 of the 1,155 acres sown were cut for hay, with an average yield of 2 tons, or an increase of 0.6 ton. Six hundred and seventy-one demonstration home orchards were under the care of county agents, with a total of 38,089 trees; 1,571 orchards were inspected by the agents and advice given as to pruning, spraying, etc. Twenty-six pure-bred horses, 643 pure-bred dairy cattle, 270 pure-bred beef cattle, 379 pure-bred hogs, and 243 pure-bred sheep were brought into the various counties through the influence of the agents. Six thousand four hundred and fifty-seven cattle were

treated for blackleg, and 5,519 hogs treated for cholera by county agents. Eight hundred and twenty-four silos were built in counties where there were agents, 393 as a direct result of their advice. One hundred and eighty-five communities were influenced to buy fertilizer cooperatively; 10,744 farmers advised as to its proper use; and $20,712 saved by cooperative buying of fertilizer. Two hundred and forty-four manure sheds were built at the agents' suggestion, and 2,949 farmers induced to take better care of farm manures. Sixteen lime crushers were installed, 197 lime kilns built, and 39,471 tons of lime used, due to influence of agents. Agents were assisted in organizing 149 farmers' clubs, with a total membership of 4,533, and 8 community breeding associations were organized. Nine hundred and sixteen farm buildings were erected, improved, painted, or whitewashed through the agents' influence; 83 lighting systems and 123 water systems installed; 595 sanitary conditions improved; 1,469 homes screened; 4,543 farm implements bought; and 35 county fairs held.

The county agents in Virginia have always conducted the boys' club work as a part of their work, and there has never been a separate project or leader. There were 2,724 boys enrolled in boys' clubs in 1915; 2,419 in corn clubs, 145 in peanut clubs, 85 in potato clubs, and 75 in pig clubs. Complete reports of 670 boys enrolled in the corn clubs showed an average yield of 54.9 bushels of corn, raised at an average cost of 36⅕ cents per bushel. Virginia had the distinction of having the champion boy corn grower of the United States for 1915, who raised 209.7 bushels of corn on his acre, at a net cost of $11\frac{3}{10}$ cents per bushel. As an evidence of the interest being taken in boys' club work in Virginia, over $5,000 was contributed by various persons throughout the State as prizes to the boys making the best records in the different clubs.

Specialists.—Most of the work of specialists was done in counties where agents were located, assisting in work already started, inaugurating new lines of activity, and giving demonstrations. The county agent followed up the different lines of work started by the specialists, to see that they were carried out successfully.

Girls' clubs and home demonstrations.—A woman State agent, 1 district, 20 county, and 7 assistant women agents were engaged under this project. Of these county agents, 9 were employed for 12 months in the year, and all for at least 5⅓ months. This work is financed similarly to that of the county men agents.

In pursuance of their work during the year, those employed under this project enrolled 1,819 girls in canning and poultry clubs, and 350 women in home demonstrations. The members of these clubs canned 394,797 pounds of tomatoes. In addition to the foregoing the agents traveled 77,584 miles by rail and team, held 653 meetings with a total

attendance of 52,265 persons, visited 7,160 homes, gave 390 home and public demonstrations, made 35 flytraps, 28 fireless cookers, 10 iceless refrigerators, 38 other devices, and were instrumental in getting 29 homes screened and 53 barrel waterworks put in.

OTHER EXTENSION WORK.

Horticulture.—Two specialists were engaged in extension work along this line, one of whom divided his time, giving a part to the experiment station.

During the year these specialists visited 33 agents, 99 orchards and farms; gave about 50 spraying, pruning, and packing demonstrations; worked out plans and selected sites for 17 orchards; visited 91 farms; spoke at 69 farmers' meetings to 9,128 persons; conducted 2 apple-packing schools of 10 days' duration; also prepared 4 extension bulletins and circulars.

Hog cholera.—Work in the control of hog cholera was conducted in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, and was a part of the plan of work for the assistance of county agents. The principal activity of the specialist employed under this project is the instruction of county agents and farmers in methods of handling outbreaks of hog cholera through serum treatment, proper sanitation, feeding, and care. During the year 1914–15 he visited 39 county agents and 51 farms; gave 11 demonstrations of preventive treatment, treating 53 hogs before 421 farmers; made 15 addresses at farmers' meetings, with an attendance of 11,513 persons; had 170 personal interviews with hog raisers, and instructed 52 as to the proper way to use serum. A circular and an illustrated poster on hog-cholera prevention and control were prepared.

Drainage.—Under this project the specialist employed, working largely through county agents, made necessary surveys and maps for drainage work, partially superintended the construction of systems, etc. Among other things, he made 18 surveys for drainage systems, which covered 1,346 acres; aided in 67 small drainage projects; personally superintended the construction of two drainage systems; wrote several newspaper articles and 270 letters; and mapped out plans for 734,730 feet of tile.

Animal husbandry.—The specialist visited 50 county agents, 85 farms, 28 schools, and judged at 7 county fairs; wrote 15 newspaper articles and circulars, 1,685 letters, and mailed out 2,500 circulars and bulletins to farmers; spoke at 105 farmers' meetings, with an attendance of 25,500 persons; helped organize 8 community breeding associations, with a membership of about 275 farmers; was instrumental in getting 75 silos erected, 15 farmers to keep milk records,

27 farmers to feed beef cattle under directions; and worked out feeding rotations for 450 farmers.

Dairying.—The head of the animal husbandry department of the college devoted a part of his time to extension work in dairying, particularly creating interest in cheese factories among farmers remote from the railroads. Advice regarding regular testing of cows was also given and a number of cows were tested. During the year this specialist attended 25 meetings and addressed approximately 2,750 persons.

Poultry clubs.—The work under this project was in cooperation with the Bureau of Animal Industry of the United States Department of Agriculture. The specialist carrying on this work in Virginia was in close touch with all county workers, and with their assistance, during the year 1915, organized 23 clubs in 6 counties, with a membership of 202 boys and girls, who made a total profit of $1,719.23. Seven adult clubs were organized, with a membership of 104, working along the lines of community marketing of eggs and breeding of poultry. Besides work with the above clubs, 7 farmers' meetings were addressed, 15 caponizing demonstrations given, and 81 public schools visited.

Work among negroes.—This work was carried on in the same manner as with county agents and under like supervision of the State agent. Under him were 15 negro local agents, working in one or more counties each. A negro district agent was appointed to give their work the close supervision necessary. The negro schools at Christiansburg, Petersburg, Lawrenceville, and Hampton cooperated by furnishing office room and paying a portion of the salaries of the agents in the counties where they were located. Hampton Institute also furnished an office and stenographic assistance for the district agent. During the year the fiscal courts did not appropriate any money toward the salaries of these agents. A brief statement of the more important results accomplished is here given:

These agents made 5,101 visits to demonstrators, 2,365 to cooperators, 2,424 to other farmers, 743 to business men, and 695 to boys' and girls' club members; traveled a total of 60,497 miles and held 652 meetings, with a total estimated attendance of 34,194 persons; held 176 field meetings, with an attendance of 1,612; wrote 3,048 letters, 17 newspaper articles, and mailed out 17,455 bulletins and circulars. Two thousand two hundred and seven acres of corn were grown under their direction, with an average yield of 30.6 bushels per acre, an increase of 9.8 bushels per acre due to improved methods. Twenty-six acres of cotton were grown, with an average yield of 750 pounds of seed cotton per acre, an increase of 250 pounds. Wheat, 1,325 acres; average yield, 14 bushels per acre; increase, 3 bushels per acre. Oats, 357 acres; average yield, 16 bushels per acre; increase,

4 bushels per acre. Alfalfa, 14 acres; average yield, 2 tons per acre. Combinations of oats, vetch, or crimson clover, 83 acres; average yield, 2.18 tons per acre. Grasses and clover for hay, 689 acres; average yield, 1.83 tons; increase, one-third to one-half ton per acre. Cover crops of crimson clover, 666 acres, and rye, 444 acres. A large part of each was grazed off or turned under for soil improvement. Soy beans and cowpeas, 754 acres; average yield, 1.54 tons; increase, one-half to one ton per acre. Peanuts, 21 acres; average yield, 47 bushels; increase, 22 bushels. Thirty-eight pure-bred hogs were brought into the counties. One thousand eight hundred and twenty farmers were advised regarding the proper use of fertilizers; 1,425 farmers were induced to take better care of farm manures; 239 farmers influenced to use 674 tons of lime. One hundred and ninety-six boys were enrolled in the negro boys' farm-makers' clubs to grow corn; 116 reported, with an average yield of 27.8 bushels per acre. Six hundred and sixty buildings were erected, improved, painted or whitewashed, 350 sanitary conditions improved, 388 homes screened, and 275 improved farm implements purchased, due to influence of the agents. Seventy-two farmers' clubs were organized, with 854 members.

Work among negro girls and women.—A very important piece of work was conducted for the purpose of instructing negro farm women and girls along various lines of home economics and girls' club work. The main effort was directed toward the production and canning of fruit and vegetables, and the introduction of simple home conveniences, such as screening of windows, painting and whitewashing the premises, and similar household devices.

In this work cooperationn was obtained from the State department of education. Hampton Institute cooperated by furnishing office, stenographic help for the negro woman district agent, who supervised this branch of work. They also furnished certain specialists from the home-economics department of that institution. Through the State department of education the cooperation of 26 negro rural supervising teachers was obtained. All of this work was under the State agent for girls' canning and home demonstration.

For the year 1914–15 the district agent, in pursuance of her duties, traveled 13,459 miles; visited 200 homes, 50 clubs, talked with 1,000 club members and 20 superintendents of education; visited 145 schools and spoke at 50 other meetings, with an attendance of 15,339 persons.

The supervising industrial teachers enrolled 2,155 girls, who worked 656 individual gardens. Some of the girls worked in the family gardens as well. These girls put up 57,297 quarts of fruit and vegetables. The enrollment of women who did active work was 995.

They put up 62,713 quarts of fruit and vegetables, making a total of 120,010 quarts. A great many homes were screened against flies and whitewashed, due to influence of the agents' work.

Exhibits were made at 18 county fairs.

Extension activities of State department.—The State department of agriculture conducted farmers' institutes under authorization of law. Each year farmers' institute trains and boats are run. In many instances the transportation companies along whose lines these institutes are held, furnish conveyance free. As far as means permit, other meetings as well are held over the State.

The same department also issues a monthly bulletin, miscellaneous in character, devoted to agricultural topics. During the year 1915 1,000,000 such bulletins were distributed through a mailing list of 70,000 and otherwise.

Hampton Institute does agricultural and home-economics extension work among the negroes of the State by sending speakers to meetings in response to requests, conducting an annual farmers' conference, holding an agricultural, home-economics, and school exhibit, furnishing stenographic assistance, offices, etc.

OUTLOOK.

The extension work is organized along lines to meet, as far as possible, the needs of the farmers of the State and their families. Definite plans are under way which promise much improvement and development in all lines of the work.

WEST VIRGINIA.

Division of Agricultural Extension, College of Agriculture, West Virginia University, *Morgantown.*

C. R. Titlow, *Director.*

History.—The first public step toward the betterment of agricultural conditions in West Virginia seems to have been the founding of the West Virginia Agricultural College in 1867, made possible when Congress, in 1864, extended the act of 1862, establishing "colleges for the benefit of agriculture and mechanical arts," to the new State of West Virginia. The Woodburn Seminary and Monongalia Academy, both of Morgantown, were donated to the State for this purpose. The latter had been incorporated by an act of the legislature of Virginia passed in 1814. In 1868 the name of the new institution was changed to its present title, the West Virginia University.

The early agricultural course of the college consisted of volunteer corps, working for a prize offered for the best cultivated piece of ground. This feature seems to have disappeared about the year 1873

and the course itself to have had an uncertain and perfunctory existence until 1891, when a professor of agriculture was elected and a course arranged leading to the degree of bachelor of science in agriculture. After two years the professor resigned, and from 1893 to 1897 the course became practically a dead letter. In 1897 the college of agriculture of the West Virginia University offered five regular courses, one of which was "the agricultural home reading course" for those not attending the university.

The agricultural experiment station was established in 1888, when the governor formally accepted the appropriation made by act of Congress, March, 1887. The legislature assented in February, 1889.

The first movement for the organization of farmers' institutes in West Virginia was in February, 1889, when a number of farmers met in Wood County and formulated a plan for the organization of a society to be known as the Farmers' Institute Society of West Virginia. This was accomplished in June of the same year and the first meeting held that month. At this time cooperation was effected with the experiment station.

The West Virginia Legislature, on March 13, 1891, passed an act creating the State board of agriculture for the purpose of advancing the agricultural interests of the State. That same year, in a joint session of the board and a committee of the West Virginia regents, it was decided to hold a series of farmers' institutes, the West Virginia Experiment Station cooperating by furnishing certain speakers. Five of these were held. In 1895 the legislature, among other things, specified the "holding of farmers' institutes, organization of agricultural and horticultural societies, and other associations" as duties of the board of agriculture. In 1897 a superintendent of farmers' institutes was appointed. By persistent efforts the number of institutes was increased until from 70 to 80 were being held annually in 1905 and 1906. Besides farmers' institutes the board of agriculture established a newspaper, printed bulletins, and gathered statistics.

In 1913 all extension work of the board was transferred by an act of the legislature to the control of the extension department of the West Virginia University.

The college of agriculture began some extension work as early as 1908, but no systematic or organized work was conducted until January 1, 1912. At that time there was a State appropriation of $5,000 for horticultural extension. This sum was supplemented by a small amount from other funds of the university and from the United States Department of Agriculture. The State legislature of 1913 increased the appropriation to $15,000 for the nine months ending June 30, 1913; $30,000 for the fiscal year ending June 30, 1914; and $35,000 for the fiscal year ending June 30, 1915. The

same legislature officially created the extension department of the West Virginia University.

In August, 1912, the first county agent was appointed in the State under the joint supervision of the Office of Farm Management, United States Department of Agriculture, and the extension department of the West Virginia University. Before the end of the fiscal year two other agents were appointed. These were transferred from the Office of Farm Management to that of farmers' cooperative demonstration work July 1, 1913. During the fiscal year 1913–14 State agents in charge of county agents and boys' club work, respectively, were appointed, as well as four additional county agents. The General Education Board of New York, in cooperation with the United States Department of Agriculture, paid $9,778.21 toward the support of the work that year.

The girls' canning and poultry club work was organized July 1, 1913, when a State agent was appointed. During the fiscal year 1913–14 nine women county agents were employed. The general education board also financed this project to the extent of $1,491.05. On July 1, 1914, the funds of the general education board were entirely replaced by those of the United States Department of Agriculture and its connection with the extension work terminated. The assent of the governor of the State to the Smith-Lever Act was given May 19, 1914, of the State Legislature, January 26, 1915. A general memorandum of understanding, governing cooperative extension work in the State, was signed by the dean of the college of agriculture June 26, 1914, and by the Secretary of Agriculture July 2, 1914, according to the provisions of the Smith-Lever Act.

Extension is one of the three general divisions of work of the college of agriculture. A director, who is responsible to the dean of the college, is the chief administrative officer.

Organization and administration.—Under the director is an administrative assistant, who, jointly with the director, has charge of extension schools, farmers' institutes, farmers' reading circles, and correspondence courses; a State agent and one district agent in charge of county agents; a State agent in charge of boys' agricultural clubs, and boys' club agents; a State leader in charge of girls' clubs and girls' club agents; a leader in charge of home-economics extension work; an agricultural editor in charge of publications; specialists in horticulture, agronomy, animal husbandry, soil improvement, dairying, and agricultural education.

Relations of the agricultural-extension department to other organizations or agencies.—The agricultural-extension department has no relation to the experiment station except through the dean of the college of agriculture, who is also the chief administrative officer of the experiment station. This forms a very close cooperative relation

to the station. The agricultural-extension department cooperates with the commissioner of agriculture in the dissemination of information regarding the control of diseases of live stock and in other forms of his work. Very satisfactory cooperative relations were formed with the department of free schools through the activities of the boys' and girls' clubs and through the department's efforts to advance the teaching of agriculture and home economics in rural schools.

Publications.—During the fiscal year 1914–15, 28 circulars, 2 farm bulletins, and 2 numbers of the School Agriculture series, a total of 316 pages, were published. Editions varied from 1,000 to 11,000, and totaled 163,500 bulletins. Besides these publications, five news letters and eight special sheets on definite subjects were sent to newspapers of the State. The material for these publications was prepared by the specialists of the department and the college, or by those of the department in immediate charge of special forms of extension work, and in every case was approved by the director.

Finances.—Funds for extension work in the year 1914–15 were obtained from the following sources:

State appropriation for agriculture, horticulture, and home-economics extension	$35,000.00
Smith-Lever funds received from the Federal Government	10,000.00
County courts and county and local organizations	11,699.52
Miscellaneous fees from correspondence courses, etc.	344.92
United States Department of Agriculture, farmers' cooperative demonstration work	25,000.00
United States Department of Agriculture, Bureau of Animal Industry	1,155.00
Total	83,199.44

During the fiscal year 1914–15, Smith-Lever funds were expended through the following projects: Organization and administration, county agents, extension schools, boys' club work, girls' club work, and home economics.

The Smith–Lever moneys from the United States Department of Agriculture are sent direct to the State treasurer, where they are held subject to the order of the State board of control. This board, under the law, has charge of all expenditures for State public institutions.

A detailed financial statement, showing the expenditures of these funds was submitted and approved.

SMITH-LEVER PROJECTS.

County agents.—A State agent is in immediate charge of this project, with a district agent to assist in directing and supervising the work in the counties. Twenty-eight of the 55 counties of the

State were provided with agents, a net increase of 10 agents during the year.

The first step toward the employment of a county agent in any county in West Virginia is the organization of an agricultural society. The second step is the making of an agreement between that society and the agricultural-extension department of the college, whereby the society agrees to pay a part of the salary and all of the local traveling expenses of the agent, and the extension department agrees to provide the remainder of the salary from Smith-Lever funds and direct appropriation from the United States Department of Agriculture. The funds from which the society makes its payments are secured through membership fees and contributions from those interested in the work.

Within any county the agent is considered in general charge of the plans for extension work in that county, under the direction of the department of agricultural extension of the college, and he coordinates the work of other representatives of that department in the county.

The more important results of the year's work of these agents, ending December 31, 1915, are summarized as follows:

One thousand one hundred and ninety-four farms conducted demonstrations; 833 acres were tile-drained; 5,693 acres were treated with lime, and 24,781 acres were treated with phosphorus; 15,035 tons of manure were saved by extra care; 15,407 acres of winter cover crops were grown to be turned under. Three thousand six hundred and sixty-eight acres were in demonstration crops, with average yields as follows: Corn, 54 bushels per acre; potatoes, 215 bushels; alfalfa, 3.6 tons; soy beans, 2 tons. Five hundred and twenty-nine silos were erected and filled for the first time; 170 new barns and poultry houses were built; 3,579 cattle received balanced winter rations; 700 dairy cows were tested for butterfat and record kept of their milk; improved methods were followed in caring for poultry, working with 10,083 fowls; 437 farmers pledged themselves to use only pure-bred sires; 69 shows and 1,927 field and community meetings were held; 196 farmers' clubs were organized and a saving of $33,328.50 affected by cooperative purchasing.

Boys' clubs.—The boys' agricultural clubs and boys' club agents are under the direct charge of a State agent, who reports to the director of extension work. Under the laws of the State, the "board of education of any district or independent district, or any county high school board, * * * may, at their discretion, provide for the continuation of industrial and vocational instruction beyond the regular school term." Twelve district superintendents of schools, supervising a portion of a county each, were employed to devote the summer months to the organization of boys' clubs in each community

in their respective districts, and to give each member and club close supervision. In many communities of the State volunteer leaders carried the responsibility of the local boys' clubs. There were five contests in this work, namely, those with an acre each of corn, with seed-corn plats, with potatoes, pigs, and poultry.

The enrollment in these clubs in June, 1915, was as follows: Corn, 2,515; potato, 916; poultry, 1,365; pig, 236.

Girls' clubs.—A State leader has charge of the girls' club work. The laws of the State make it possible for the district boards of education and county courts to appropriate funds for this work. During the fiscal year 1914–15 agents in 11 counties organized clubs, with an enrollment of 2,082 members. The total yield of tomatoes from the one-tenth acre plats for all club girls was 303,320 pounds. Besides tomatoes, other vegetables and fruits were preserved and canned to the extent of 31,112 containers.

Home economics.—This project was organized during the fiscal year 1914–15, with a trained woman in charge. During the year this specialist took part in 116 farmers' institutes, gave instruction in home economics in 6 movable schools, organized 16 women's clubs, prepared 1 correspondence course, published 4 bulletins, and outlined a course in cookery for rural schools.

Extension schools.—These schools are granted upon request from interested individuals or organizations. Applications must be signed by not less than 20 persons who agree to provide at their own expense a suitable room for the school and pay a registration fee of 25 cents each for half-day schools, or 50 cents for full-day schools. The work given at these schools is much more scientific and thorough than can possibly be given at farmers' institutes, as the instructors remain sufficiently long to learn the local problems and to discuss them fully. In a few sections where these schools have been held the people do not now apply for the regular farmers' institutes.

Only one agricultural and one home-economics extension school, of three courses each, is held in each county, lasting for four days. During the year six such schools were held, with a total attendance of 1,023 persons.

OTHER EXTENSION WORK.

Farmers' institutes.—As stated before, the legislature of 1913 placed farmers' institutes under the control of the agricultural-extension department of the college. This has made it possible to follow them up with definite farm demonstrations as conducted under other projects. Each year before the institute season begins a conference of the speakers is held at the university. During the year 324 institutes were held, with a total attendance of 64,135.

Fair exhibits.—During the year a large educational fair exhibit was placed at 13 county and local fairs in the State. Two or three

men accompanied this exhibit to answer questions. It is estimated that 60,000 persons visited and studied this exhibit.

Farmers' reading circles.—In 1913 the agricultural-extension department outlined a plan of definite reading for farmers. It seemed advisable for groups of farmers of one community to get together for their reading and that they have definite topics for discussion. So far four reading-circle courses have been offered on soil fertility, animal husbandry, general horticulture, crops, and methods for soil improvement. This form of work was very popular among the farmers during the winter months and gave the county agent a working basis for his local clubs.

Correspondence courses.—Instruction in agricultural subjects by mail was taken up for the first time by the extension department during the fiscal year 1914–15. In all, 15 courses were offered, nine of these consisting of 20 lessons each and six of 10 lessons each. The lessons were prepared and manuscripts graded by the regular teachers in the college of agriculture. Three hundred and five persons were enrolled during the year.

Dairy extension work.—This work is conducted in cooperation with the Bureau of Animal Industry, United States Department of Agriculture, and is a part of the plan of work for the county agent. The specialist employed under this project reaches the farmers through talks, institutes, extension schools, dairy and silo campaigns, and personal visits, in cooperation with the county agent. Under his supervision 4 live-stock organizations were formed, approximately 200 silos erected, 19 dairy barns built, planned, or remodeled, 18 men induced to keep complete herd records, and 35 induced to weigh their milk, and cream routes also were established.

Other specialists.—The following men were employed a part of their time to do extension work: Professor of horticulture and two assistants, professor of agronomy and two assistants, professor of soils, professor of farm management, professor of dairying and one assistant, professor of animal husbandry, and the associate professor of veterinary science. While these men were engaged in extension work, their time was spent in movable schools, farmers' institutes, with county agents, etc. Reports of the results of their work are included in those covering the above activities. In all of these lines the specialists rendered efficient service.

Agricultural education in the public schools.—The extension department of the college is working in cooperation with the superintendent and State board of education. A new course of study for public schools was written. Special cooperation was effected between the extension department and the county and district superintendents of the State, by which the department assisted with outlines and plans for teaching agriculture in the schools. Assistance was

given to rural teachers by means of publications and individual attention to their needs. Several circular letters, outlining projects suitable for school work, were issued. The specialist in charge of this project reached 10,300 persons, in 121 addresses.

No agricultural-extension work is done in the State except that in cooperation with the extension department of the college.

OUTLOOK.

The extension work is organized along practical lines, meeting the needs of the rural life of West Virginia, and conforming to the laws of the State. Plans are under way, looking ultimately to the employment of a man and a woman county agent, working 12 months in the year, in each county of the State. A healthy spirit of cooperation exists between the various divisions of the college and experiment station and the extension department. The several agricultural associations in the State are working in full accord with that department.

EXTENSION WORK IN THE NORTH AND WEST.

INTRODUCTION.

During the year 1914–15, in the 33 Northern and Western States, cooperative relations were maintained between the Department of Agriculture and the agricultural colleges. The outstanding feature of this important relationship has been the establishment of a definite extension division at the agricultural college with a responsible director acceptable to the department to have charge of all the extension work in agriculture and home economics undertaken by either the agricultural college or the United States Department of Agriculture within the State. This arrangement has made possible the handling of the extension work of both the colleges and the department through one extension organization. The two institutions thus approach the farmers as a unit, the extension agent representing in his work both institutions. This arrangement has tended to eliminate misunderstanding and friction that might otherwise arise through two independent extension agencies undertaking extension work with the same group of people, and at the same time has brought to the farmers through one agency the combined information of the land-grant colleges and the United States Department of Agriculture.

The essential features of field work during the year has been largely a further development and strengthening of lines of work already under way. By far the larger part of the funds available for extension work has been used in the extension of the county-agent work. This type of work has been accepted by every Northern and Western State as an essential feature of any substantial extension system designed to keep in constant touch with the needs of farmers and at the same time in touch with the original sources of information for help in meeting these needs. The developments of the year have shown the increasing need of close cooperation with the farmers in the organization and financing of the county-agent work and in the making out of local programs of extension work.

The year has seen greatly increased attention given to extension work in home economics for farm women. This phase of the work is still new and not yet well organized. The main feature of this work has consisted in the holding of extension schools in home economics for farm women, with a good deal of itinerant lecture work before clubs and other organized groups of women. Two counties, one in New York and one in Missouri, through the farm-bureau organiza-

tions employed a woman county agent to give her whole time to the extension needs of the women of the respective counties. The growing interest manifested in extension work in home economics by women's organizations, clubs, and farm organizations of various kinds bespeaks the rapid expansion and more definite organization of this work in the years to come. The home-economics project ranked fourth in the amount of funds employed in extension work during the year.

Much progress was made during the year in the boys' and girls' club work. This work has been organized with primary reference to interesting boys and girls in the best things of agriculture and home economics in such a way as to teach better agriculture and at the same time maintain or increase the interest of rural boys and girls in rural life. While in amount of funds used this project stands sixth on the list, the close coordination of the work with the public-school systems has made possible the reaching of large numbers of young people at minimum cost and to the advantage of both school work and agriculture. A feature of the year's work has been the unifying of the methods and standards of work through conferences of the leaders of the work both in national and State meetings. The county farm bureaus, with the county agents and the boys' and girls' club work, are rapidly providing the machinery through which any important matters relating to agriculture or home economics which the colleges or department may have for extension can promptly reach the ultimate farm family.

Working in entire harmony with those organized extension forces and for the purpose of reinforcing them where needed along subject-matter lines, both the land-grant colleges and the United States Department of Agriculture have employed a small number of specialists who give especial attention to such matters as dairying, field crops, live-stock improvement, disease control, farm management, and like matters. Probably the two special lines given most attention during the year were extension work in dairying and the organization of extension work in farm management. Both of these lines have been handled very successfully during the year and are mentioned in detail further on in this report. Speaking broadly, the work of the specialists has not been as carefully planned and organized with reference to follow-up instructions, economy and results, nor as closely coordinated with the work of the county agents as would seem desirable. Extension directors have been quick to see this, however, and later projects covering this work have been more definitely framed to meet these ends.

On the whole, the extension work of the year has made decided progress as regards vision of the work, the perfection of the organization for it, the establishment of harmonious cooperative relations

between Federal, State, and local organizations in conducting the work and in the effort to reach the individual farmer and local groups of farmers by the demonstration method and through the living agent to bring the personal message of better agriculture to the community.

In the following pages there is first presented the method of organization and some results secured under the several more important extension projects carried on in the Northern and Western States followed by a more detailed statement of the history, organization, and results of extension work secured in each of the 33 Northern and Western States.

ADMINISTRATION.

The provisions of the Smith-Lever Act indicate certain administrative requirements for planning extension work and making reports thereon, for the purpose of coordination of effort, economy of moneys expended, and for furnishing the public with information on results secured. Section 3 of the act provides that projects for the work shall be submitted to and approved by the Secretary of Agriculture before Smith-Lever funds are available to any college for the work. Section 4 provides that a detailed financial report shall be made to the Secretary of Agriculture on forms prescribed by him, and section 5 requires that "a full and detailed report of its operations in the direction of extension work as defined in the act, including a detailed statement of receipts and expenditures from all sources for this purpose," shall be made by the college to the governor of the State in which it is located and "a copy of this report shall be sent to the Secretary of Agriculture and the Secretary of the Treasury of the United States."

The memorandum of understanding already referred to (p. 10) has been signed by all the States of the northern and western division except two. The following table shows the dates of signing of this memorandum and of acceptance of the terms of the Smith-Lever Act:

TABLE XVI.—*Dates of signing of memorandum of understanding, acceptance of terms of Smith-Lever Act, and State repository of Smith-Lever funds in northern and western States.*

State.	Memorandum of understanding signed by—		Provisions of Smith-Lever Act.		State repository of Smith-Lever funds.
	President of college.	Secretary of Agriculture.	Assented to by governor.	Adopted by legislature.	
Arizona	Not signed.		May 19, 1914	Mar. 9, 1915	Boards of regents of the University of Arizona.
California	do		July 18, 1914[1]	Apr. 27, 1915	Treasurer of the State of California.
Colorado	July 30, 1914	Aug. 22, 1914	June 5, 1914	Apr. 9, 1915	State board of agriculture of Colorado.

[1] Forwarded to United States Department of Agriculture on this date.

TABLE XVI.—*Dates of signing of memorandum of understanding, etc.*—Contd.

State.	Memorandum of understanding signed by—		Provisions of Smith-Lever Act.		State repository of Smith-Lever funds.
	President of college.	Secretary of Agriculture.	Assented to by governor.	Adopted by legislature.	
Connecticut	Not given	July 23, 1914	June 2, 1914	Mar. 16, 1915	Trustees of the Connecticut Agricultural College.
Delaware	Aug. 24, 1914	Aug. 23, 1914	June 20, 1914	Feb. 9, 1915	Trustees of Delaware College.
Idaho	Aug. 27, 1914	Oct. 6, 1914	May 21, 1914[1]	Mar. 2, 1915	Treasurer of State board of education and board of regents of University of Idaho.
Illinois	Sept. 10, 1914	Sept. 19, 1914	July 7, 1914	Mar. 4, 1915	Trustees of the University of Illinois.
Indiana	June 29, 1914	July 2, 1914	June 25, 1914	Mar. 8, 1915	Treasurer of Purdue University.
Iowa	Nov. 7, 1914	Nov. 11, 1914	June 23, 1914[1]	Apr. 16, 1915	Iowa State Board of Education.
Kansas	June 23, 1914	June 27, 1914	June 2, 1914	Feb. 26, 1915	Board of administration, Kansas State Agricultural College.
Maine	do	June 25, 1914	do	Mar. 8, 1915	Trustees of the University of Maine.
Massachusetts	June 29, 1914	July 2, 1914	June 29, 1914	June 29, 1914	Treasurer and receiver general, State of Massachusetts.
Michigan	July 2, 1914	July 13, 1914	June 12, 1914[1]	Apr. 21, 1915	Secretary State board of Agriculture.
Minnesota	June 23, 1914	June 27, 1914	June 25, 1914	Apr. 17, 1915	University of Minnesota.
Missouri	Sept. 1, 1914	Oct. 7, 1914	July 2, 1914	Mar. 15, 1915	Treasurer of University of Missouri.
Montana	July 29, 1914	Aug. 3, 1914	May 18, 1914	Feb. 18, 1915	President of Agricultural College of State of Montana.
Nebraska	do	do	May 22, 1914[1]	Apr. 5, 1915	Treasurer of State of Nebraska.
Nevada	Aug. 17, 1914	Aug. 26, 1914	June 16, 1914[1]	Feb. 10, 1915	Regents of the University of Nevada.
New Hampshire	July 24, 1914	Aug. 3, 1914	June 20, 1914	Mar. 17, 1915	Treasurer of New Hampshire College of Agriculture and Mechanic Arts.
New Jersey	Aug. 11, 1914	Aug. 22, 1914	May 19, 1914[1]	Apr. 6, 1915	Trustees of Rutgers College, New Jersey.
New Mexico	July 28, 1914	Aug. 3, 1914	May 25, 1914	Mar. 9, 1915	Treasurer of board of regents, New Mexico College of Agriculture and Mechanic Arts.
New York	Aug. 12, 1914	Sept. 2, 1914	June 20, 1914	Apr. 2, 1915	Trustees of Cornell University.
North Dakota	Oct. 30, 1914	Nov. 4, 1914	May 16, 1914	Mar. 31, 1915[2]	Trustees of North Dakota Agricultural College.
Ohio	July 18, 1914	July 22, 1914	June 4, 1914	Feb. 11, 1915	Trustees of Ohio State University.
Oregon	July 28, 1914	Aug. 3, 1914	May 23, 1914[1]	Feb. 10, 1915	Regents of Oregon Agricultural College.
Pennsylvania	Oct. 1, 1914	Oct. 6, 1914	June 25, 1914[1]	Mar. 26, 1915	Treasurer of the Pennsylvania State College.
Rhode Island	June 18, 1914	June 22, 1914	May 22, 1914	Apr. 23, 1915	Board of managers of Rhode Island State College.
South Dakota	July 10, 1914	July 15, 1914	May 19, 1914	Feb. 18, 1915[2]	Treasurer of State of South Dakota.
Utah	July 28, 1914	Aug. 3, 1914	June 29, 1914	Mar. 6, 1915	Treasurer of the Agricultural College of Utah.
Vermont	Oct. 3, 1914	Oct. 8, 1914	May 29, 1914	Mar. 11, 1915	Treasurer of State of Vermont.
Washington	Sept. 13, 1914	Sept. 24, 1914	June 24, 1914	Mar. 17, 1915	Board of regents of State College of Washington.
Wisconsin	July 13, 1914	July 17, 1914	June 4, 1914	No date	Regents of the University of Wisconsin.
Wyoming	Aug. 22, 1914	Sept. 2, 1914	May 26, 1914	Feb. 11, 1915	Board of trustees of University of Wyoming.

[1] Forwarded to United States Department of Agriculture on this date.
[2] Certified by secretary of state.

Organization of extension divisions.—Many of the States had previously provided for an extension division with a director at its head. Those which had not done so proceeded to organize and with two or three exceptions the director has immediate charge of extension work. In most States it was necessary to provide assistants to the extension director who should have charge under him of the various lines of work. These included leaders of county-agent work, of boys' and girls' clubs, in home economics, and in extension schools; and agricultural specialists, office assistants, and accountants. These men are all administratively responsible to the extension director but in the case of the specialists are responsible to the subject-matter departments for matter taught. In nearly every case the extension director was associated with the college work prior to the signing of the memorandum of understanding, so that he was somewhat acquainted from the outset with the State and some of its problems as well as with the administration of the forces at the college. In three States the extension director is also dean of the college or director of the experiment station. In four States the extension director has the triple duties of dean of the college, director of the station, and director of extension work. In 14 States the directors are also county-agent leaders.

Correspondence.—In all the States a large amount of correspendence has resulted from the activities of the extension division. In some States incoming mail is generally addressed to the extension division, in others the requests are addressed to members of subject-matter departments, and in still others the requests come to the college office and are then referred. In at least two States, in addition to the copies of replies filed in the office of the extension director, extra copies are sent to the agent in the county where the inquirer lives, so that the agent may be notified of both the desire for information and assistance and the nature of the reply made.

Accounts.—In the beginning the requirements of the Smith-Lever Act for accounting were not well understood by extension directors. As the work has proceeded, however, the directors have been able to handle the accounts with less effort by devising a satisfactory requisition and voucher system. Accounts and vouchers for funds for extension work are kept at the college regardless of their place of origin. If the college has only duplicate vouchers, evidence of their payment appears by reference to the warrants or otherwise. All vouchers bear the approval of the extension director or acting extension director. On each voucher are shown the account against which the expense is charged, the classification of the items according to the main headings in the financial schedule, the signature of the payee, the indorsement of the director of extension, and the project against which the expense is made.

Responsibility of assistants.—In most States all extension assistants are administratively responsible to the extension director, but in a limited number of States the extension specialists are responsible to the subject-matter departments not only for the material presented but for their time, which makes difficult the efficient conduct of extension work.

In all cases it appears that the extension specialist, while administratively responsible to the director, is responsible to the respective subject-matter and research departments for the subject matter taught and in some degree for the methods of presentation. Most States find it to be satisfactory to have the extension specialists in very close touch with the extension director, and for this reason many States are endeavoring to provide office room for extension specialists in the extension section and allow frequent conferences with subject-matter departments.

Advisory council.—A few States have definite extension councils for determining some of the extension policies. In these cases the councils are composed of the heads of the subject-matter and research departments, the leaders of extension projects, and the extension director.

Part-time help.—In nearly every institution part-time extension assistance is given by members of subject-matter departments. This assistance is usually applied to miscellaneous farm visits and meetings. It is a somewhat scattered effort and results are usually not satisfactory. Many directors are studying this part of the work with a view to correlating it so as to give direct support to extension projects.

Office equipment.—A few States have adequate office room and office equipment, some are rather cramped, and in a few States room and equipment are sadly needed. As is always true with a new and rapidly growing department, it takes some time for accommodations to be provided. Only a few of the extension offices are thoroughly equipped with modern labor-saving devices for administering field work. An effort is being made to secure necessary equipment, including duplicating machines, addressing machines with selective devices, correspondence, card, and bulletin files, dictaphones, adding machines, and other equipment of a modern business office.

Reports to the director.—Many of the extension directors realize the administrative necessity for having a daily itinerary of extension workers filed in their offices. These itineraries not only enable the extension director to keep in touch with the field men, but enable him to give them assistance when needed and also help both the director and extension worker to determine that the time is actually used in developing the definite projects. Practically all extension directors receive from extension workers a weekly summary report covering

the activities of the week and the major features of results and needs as shown by the work of this period. In unusual cases special reports additional to the weekly summary are made to the director in the form of a memorandum which may serve in the development of future work. Daily and weekly reports of the individuals, as well as special and annual reports, serve as the basis of the director's report to the dean and president.

Correlation of divisions of work.—Under the memorandum of understanding all extension work of the State agricultural college and any extension work conducted by the United States Department of Agriculture within a State comes under the supervision of the extension director of that State. In States where there are many extension specialists or where numerous subject-matter-department specialists give part time to extension work, some extension directors have found it difficult properly to correlate the work of these several men in order to secure results which will justify the expenditures made of both time and money. In practically every instance they have found it desirable to recognize the county agricultural agent as in charge of extension activities within his county. He should know the conditions better than any one else and with such knowledge is best fitted to counsel with the extension director or specialists concerning all work to be carried on within his territory. Directors generally feel it is their duty to assist in the correlation of the work so that projects proposed by extension specialists will be of assistance to the county agent in developing projects which he has planned for his county, and the director sees to it that both the plans for work and the time of their execution harmonize with the several county projects.

In the correlation of work it is well to note the place that extension schools may hold in developing work within the county. The majority of extension directors believe that extension schools as well as farmers' institutes should supplement the work of the county agent; that schools within his territory should be conducted with his active cooperation and such matter should be presented as will tend to fit in with his extension plans.

Cooperative relations with other State institutions.—In most States there is a fairly well defined division of work between the agricultural college and other State institutions and departments. In nearly all, very close relationships exist between the State department of agriculture and the extension division and also between the State department of public instruction and the extension division. In a few States there is still some overlapping of work and division of administration, though the tendency is more and more to center educational work at the college.

Publications.—Six hundred and thirteen extension publications, aggregating 6,477 pages, have been issued in the 33 Northern and Western States during this fiscal year. Many of the publications have been used to describe the work of the extension division and have served a much needed end in acquainting the people with plans for work. In many instances the publications have been of direct value in assisting the county agent in developing his work. Some attention is needed in the selection of illustrative material to make sure that the subject matter of the photograph or cut will present a story and a lesson. From the librarian's standpoint the method of numbering extension publications should be systematized.

Mailing lists.—A few States have separate mailing lists for extension publications, but at present most of them are using the experiment-station lists, many of which are unclassified. Several of the extension divisions have installed modern addressing machines and thus economize publications by using a classified mailing list; 695,000 names are reported on mailing lists.

Sources of funds.—In the 33 Northern and Western States $2,051,000 was used for extension work during the past fiscal year. The following amounts were provided from the sources indicated: Federal Smith-Lever, $327,390; United States Department of Agriculture, $342,800 (State Relations Service, $306,180; Bureau of Animal Industry, $36,630); State appropriations, $552,990; college appropriations, $222,800; county appropriations, $388,200; other sources within the State, $216,600. (A detailed statement by States is shown in Table XXIII, p. 343.)

Smith-Lever funds were spent as follows: County agents, $94,072; administration, $56,000; printing and distribution of publications, $4,300; home economics, $42,800; miscellaneous specialists, $35,700; extension schools, $25,200; boys' clubs, $21,800; dairy husbandry, $11,900; horticulture, $10,600; agronomy, $4,900; animal husbandry, 4,200; poultry husbandry, $3,300; animal diseases, $3,800; exhibits and fairs, $3,700; farm management, $3,300; agricultural engineering, $600; entomology and ornithology, $440; plant pathology, $400; rural organization, $11.

The total funds from all sources expended by 31 States for major projects are as follows (California and New Jersey not included):

County agents, $912,100; administration, $206,800; extension schools, $176,200; home economics, $98,800; miscellaneous agricultural specialtists, $97,500; boys' and girls' clubs, $95,100; farmers institutes, $85,000; dairying, $59,500; publications, $59,000; farm management, $50,500; horticulture, $19,200; agronomy, $15,900; fairs and exhibits, $12,100; and agricultural engineering, $10,300.

Approximately 65 per cent of the total funds was used for salaries of extension workers; and over 22 per cent was used for travel ex-

penses, with only 13 per cent for equipment, labor, publications, and all other expenses.

Outlook.—Extension work is new, and most directors have felt themselves at least fully burdened with subject-matter details, and as a result have not been able to give as much attention to administrative plans and to general extension policies as they hope to in the near future.

They feel that farmers who are acquainted with the work are reasonably active in supporting it, and that the development of the work will mean increased prosperity to their States in general and to the farmers in particular. Considering the newness and magnitude of the work, they expect mistakes will be made and remedied. Constructive criticism is invited and active support needed to realize the greatest measure of results.

In view of the fact that under existing laws and agreements the State extension director becomes in a large measure responsible for the administration of the extension work of the United States Department of Agriculture as well as that of the State, it is desirable that each extension director plan to spend some time in Washington each year, learning at first-hand of the work being done by the department along different subject-matter lines, in order that he may utilize the material and forces of the department in the extension work of his State, for the benefit of the farmers, in the same manner that he uses his own State forces.

COUNTY AGENTS.

County-agent work stands first in the extension activities of the Northern and Western States, receiving nearly half of the entire money expended for all extension projects. Practically all other extension projects are correlated to support this most efficient form of extension service.

History.—The work that is now called county-agent work in the Northern and Western States was initiated in Broome County, N. Y., March 11, 1911. On that date the Office of Farm Management, Bureau of Plant Industry, of this department appointed J. H. Barron county agricultural agent for that county. The other cooperating parties were the New York State College of Agriculture, the Binghamton Chamber of Commerce, and the Delaware, Lackawanna & Western Railroad. Previous to this, in 1909, farm-demonstration work had been developed in four districts in Ohio, the Ohio Experiment Station and the Office of Farm Management cooperating; and, in 1910 local demonstration work was undertaken by the same office in Bedford and adjoining counties in Pennsylvania. The work in Broome County, N. Y., however, may be said to have inaugurated

the work on a county basis with Government, State, and local authorities cooperating.

The agent employed had been trained in the science of agriculture as well as its practice. In shaping up the work it was believed desirable that the agent at the outset first make a study of agricultural conditions in the county and then undertake such demonstration work as might be found necessary in order to meet the actual needs of the farmers as revealed by such a study. This plan in a general way has continued in all of the county-agent work since it started, because in but few States has sufficient survey or research work been done to permit putting into the hands of the county agent at the outset a definite plan of constructive work for that particular county.

The idea of cooperation in the development of agriculture in the manner taken up in Broome County seemed to appeal to business men wherever it was presented. About the time the work started in Broome County the council of grain exchanges of the Board of Trade, Chicago, offered $1,000 to each of 100 counties that should first organize in support of county-agent work. Under this stimulus and the encouragement of additional appropriations by Congress to the Department of Agriculture in furtherance of this type of work, and the favorable attitude of agricultural colleges, the county-agent movement spread rapidly. Many State legislatures passed laws permitting counties to raise funds and support the work, the administration of the work usually being under the State college of agriculture. At the present time practically all States have such laws. The passage of the Smith-Lever Act in 1914 provided a permanent fund which made practically certain the permanent development of the county-agent work in every State.

Soon after the county-agent movement got under way it was seen by those closely observing the work that, if the movement was to secure the unqualified support of farmers, its organization and administration should be chiefly influenced by the farmers themselves. In all the work of later years, therefore, the effort has been made to organize the work with a strong rural backing, and with the officers and membership largely rural.

The development of county-agent work in the North and West since the work started in Broome County, N. Y., is as follows:

At the close of the fiscal year of 1911–12 there were 3 agents; in 1912–13, 113; in 1913–14, 203; and in 1914–15, 340.

Organization.—The establishment of the extension divisions in the several States and of the States Relations Service of the United States Department of Agriculture provided means for active cooperation in developing county-agent work. In 19 of the 33 States county-agent work is immediately supervised by a county-agent leader, who

is responsible to the extension director. In 14 States the extension director is also the county-agent leader.

County-agent work is financed by (1) Money from Federal Smith-Lever Act of May 8, 1914; (2) money appropriated directly to the United States Department of Agriculture for this purpose; (3) appropriations of State legislatures, usually to State agricultural colleges for this purpose; (4) grants made by county commissioners, boards of supervisors, and other local or county authorities; (5) money raised by subscriptions, through membership fees of some association of farmers organized to assist in conducting the work; and (6) gifts from various commercial associations or from public-spirited individuals.

At the close of the fiscal year 1914–15 there were approximately 340 agents in 343 counties of the total 1,567 agricultural counties in the 33 Northern and Western States. The minimum salary is approximately $1,200 per year and the maximum $4,000, with the average about $1,700. During the year the average cost per county for salary and expenses, including clerical hire, has been approximately $3,000.

Qualifications of the county agents.—The qualifications for county agents vary somewhat in the different States. Graduation from an agricultural college is a usual although not an absolute requirement excepting in a few States. Out of 340 county agents cooperatively employed during the fiscal year 1914–15, 252, or 74 per cent, are graduates of agricultural colleges, 38, or 11 per cent, have had training at agricultural colleges, and only 50, or 14 per cent, have not had college training. Farm experience is a universal requirement. In some of the States it is required that a part, at least, of this experience shall have been received since graduation. No arbitrary age limit has been fixed, though for the most part the agents are men of maturity. The average age of county agents now at work in the Northern and Western States is more than 30 years. There are certain other qualifications, usually spoken of as "personality," that are of equal importance. The agent must possess equanimity of temperament, poise, tact, judgment, and ability to meet and win the confidence and respect of men; and, most of all, good common sense.

Duties of the county agent.—The county agent assists in the cooperative efforts of farmers within the county; aids them in finding the best available knowledge relating to profitable agricultural practices, and assists them in adapting it to their farms. He encourages and assists farmers in selecting seed, inoculating seed and soil, in mixing fertilizers, in computing rations, in treating seed and spraying plants and trees to prevent disease and insect ravages, in introducing improved live stock, and better systems of farm manage-

ment. He locates good and poor farming practices and shows how and why to take the one and avoid the other. He is a medium of exchange of local information and a trained searcher for additional knowledge which will increase net farm profits and happiness. He teaches by the demonstration method. He helps farmers by organizing them to help themselves.

As an administrator, organizer, inspirer of local leadership, his duties are manifold, his hours long, and his burden heavy; but the work is making an appeal to aggressive intelligent men who see in it an opportunity for usefulness and service.

Some tangible results of county-agent work.—At the end of the fiscal year of 1914–15, 340 county agents were at work. Agents report having visited 107,892 farmers one or more times on their own farms, and having been visited in their offices by 181,112 farmers. The agents have held 29,789 general farmers' meetings, organized 1,137 associations for the promotion of agriculture along various lines, written 12,937 timely articles for the agricultural press, and conducted 736 observation parties, consisting of 33,840 persons, to study local agricultural problems in different sections of the county.

The county agents have secured the selection of seed corn in the fields of 21,075 farmers, and have had selected seed planted on 516,094 acres, resulting in an increased yield as reported by 54 agents of 12.8 bushels per acre, due to better seed used or to the better cultural methods suggested by the agent. There were grown under the direction of the agents 216,960 acres of wheat, with a reported increased yield of 8.4 bushels per acre. The agents induced 22,762 farmers growing a total of 708,056 acres of oats to treat the seed for smut. The increased yield reported from 48 counties doing demonstration work with oats was 11.7 bushels per acre.

Agents report the growing of potatoes by 3,793 farmers who treated the seed for scab or used improved cultural methods, getting in return an average increased yield per acre of 41.8 bushels. The average increased yield on 22,150 acres of hay was 1.1 tons per acre. The agents gave instruction to 11,311 farmers for growing 92,158 acres of alfalfa.

The agents were instrumental in having the following registered stock secured by the farmers: One hundred and twenty-four stallions, 1,556 bulls, 2,103 cows, 388 rams, 458 ewes, 1,714 boars, and 1,355 cows. Four thousand five hundred and fifty-nine farmers were induced to feed more live stock, and balanced rations were figured for and adopted on 4,559 farms. The agents assisted in the organization of 142 antihog-cholera clubs and were largely instrumental in having 204,304 hogs vaccinated. In addition, 2,930 silos were put up at the suggestion of the agents, and 90 breeders' associations were organized. During the year the agents assisted in organizing 143 cow-testing

associations, testing 62,217 cows, and 16,603 cows were tested by individual farmers for economic production of milk.

Upon the suggestion of the county agents, 1,318 farmers were induced to make better use of barnyard manure; 2,121 farmers were taught how to home mix 6,779 tons of fertilizer, while 160,618 tons of lime were used, at the suggestions of the agents. In like manner commercial fertilizers were used on 5,114 farms, and 63,611 acres of clover, soy beans, cowpeas, vetch, and rye were grown for green manure.

The agents assisted in organizing 164 purchasing and marketing associations and 93 farmers' exchanges. These exchanges served as a medium through which 2,935 farmers were supplied with labor and 193 farms rented. The total value of business done in 1915 by associations organized by agents or on their suggestion was $3,575,000, with an approximate saving to the farmers of $278,000, while $10,000 was saved through reduced shipping rates secured.

The work has made a record of accomplishment. It has increased crop yields, introduced new crops, and aided in the control of insect pests and plant diseases. It has introduced improved live stock, inaugurated better feeding and breeding methods, induced better sanitation, and aided in the control and eradication of animal diseases. It has helped the farmer to conserve soil fertility and make better use of humus-forming materials. It has assisted him in marketing his products and in purchasing his supplies. It has developed better systems of farm management, assisted in securing farm laborers, and assured to the farmer a more adequate return for his investment and labor. It has helped to make life in the country more satisfying through the installation of home conveniences and to lighten the burden of the farm women through interesting the young people in wholesome rural activities and through the creation of a genuine community spirit of self-help, self-improvement, and self-assertion.

At the close of the calendar year 11,991 farm-analysis records had been taken by county agents and special farm-management demonstrators. Three hundred and ninety meetings were held to discuss this work, and 6,053 records have been returned. As a result of this work 1,195 farmers planned to reorganize their business, follow-up work was arranged with 1,159 farmers, and 1,553 farmers have agreed to begin to keep some system of farm records.

Important teachings of the county-agent work.—As a result of experiences in the various States during the development of county-agent work it would appear that—

(1) The county agent of the North and West is essentialy an organizer and administrator of all the extension forces operating within the county for the purpose of increasing efficiency and profitableness of farming.

(2) The county should be well organized, the work of the agent clearly explained, and a large body of farmers thoroughly in sympathy with the work before an agent is placed in a county, but a county-wide organization is of little value unless the agent and farmers use the organization. The program of work of the county agent, therefore, should be formulated in conference with the farmers themselves.

(3) The idea is that farmers are not being shown; they are associating together and teaching themselves aided by paid leadership. Farmers learn as they do for themselves, not as they have things done for them.

(4) The work of the county agent should be definitely drawn up on a project basis, the farmers, the agent, and the college all agreeing on the program.

(5) The county agent is the direct representative of the agricultural college and the United States Department of Agriculture, as well as a representative of the county organization. Through him, or in cooperation with him, all State and Government extension work should be carried on within the county.

(6) The agent's big field of work is that of a demonstrator, but he deals with individuals in this work only as they represent groups. Field meetings on the demonstration plats are an essential part of practically all demonstration work.

(7) Demonstrations are essentially of two kinds: (*a*) The kind the agent finds already worked out by successful farmers when he takes up work in the county. Upon these hinge practically all of his other demonstration work. These give the county agent the clew as to what is right in agriculture in that community. (*b*) The demonstrations planned for by the agent and either directly or indirectly supervised. These give the farmers confidence in the agent's practical knowledge of agriculture, and constitute centers of community meetings and influence.

(8) Upon taking up work in a county the agent needs two programs: One to meet the immediate expectations of those cooperating in his employment, which shall win the confidence of farmers as to his practical ability; the other a permanent program designed to effect fundamental improvements in the profitableness of the agriculture of a county.

(9) In the North one of the best means yet found for assisting the county agent in formulating his permanent program of work within the county is thorough farm-management demonstrations.

Outlook.—The growth in county-agent work has been steady with practically a uniform increase in the number of agents from year to year. On July 1, 1911, there were but three county agents in the Northern and Western States in cooperation with State colleges and

the United States Department of Agriculture, while on December 31, 1915, there were 368. Less than 10 per cent of the counties which have once established the work have discontinued it. This is especially encouraging because the work is so new.

In all States special emphasis is placed on having the agents devote their time to definite demonstration work following carefully drawn-up plans or projects. An attempt is made to have the best known agricultural principles and practices demonstrated on a sufficient number of farms in each community to convince all progressive farmers interested that the methods recommended are practical and profitable. Those in charge of the administration of county-agent work realize fully that the growing of two blades of grass where one grew before is of little benefit to the farmers unless the net returns per acre or per hour are increased.

Less time is now devoted to miscellaneous lecture work and more time is being given up to a few carefully organized campaigns to get some of the best agricultural practices for each locality adopted by as many farmers in each county as possible. One of the greatest needs in the administration of county-agent work at the present time is more follow-up work, since teaching better methods can be of but little value unless they are actually put into use by the farmers.

One of the brightest prospects in the development of the county-agent movement is the rapidly increasing tendency toward a strong county organization composed principally of farmers, officered and controlled by farmers to support and direct the work locally.

BOYS' AND GIRLS' CLUBS.

Boys' and girls' club work, or junior extension in agriculture and home economics, is an organized system of extension teaching for young people through demonstrations in the field and home. It contemplates the organization of young people into groups called clubs, for the purpose of definite work under carefully prepared projects and with adequate local leadership. According to money reported by extension directors as expended, club work holds sixth place in extension projects for the year 1915, $95,000 being used for this purpose.

Club work in the North and West was first started in a few of the Northern States as independent efforts by county superintendents of schools and was conducted mainly as a contest in the growing of crops, raising of poultry, etc., in connection with the schools. A lack of definite and continuous paid leadership, as well as a fixed policy for the continuation and development of the work, prevented the movement from making much headway. During the years 1904, 1905, and 1906 the extension departments of the State colleges of agriculture in Iowa, Indiana, and Ohio, together with some of

the departments of education, took up extension work along the lines of corn clubs or contests, home-garden projects, poultry, milk-testing work, and made them State-wide activities.

In the spring of 1912 the United States Department of Agriculture made arrangements through the Bureau of Plant Industry, Office of Farm Management, to cooperate with the States in promoting club work. Funds were made available August 15 by the Federal Congress of the same year, and two cooperative leaders were employed to start the organization and promotion of this type of extension work in the States of Iowa and Indiana. During the summer of 1912 an enrollment of 22,000 boys and girls was secured in five definite club projects—corn, potato, poultry, home garden and canning, and the home-garden clubs; local leaders were found, organizations perfected, and follow-up instructions furnished. In 1913 four additional States, Massachusetts, Nebraska, Utah, and Michigan, were added to the cooperative list of States into which cooperative leadership was placed. The enrollment for this year was 71,950 boys and girls. In 1914 cooperative relations were perfected between the United States Department of Agriculture and 15 additional States. The total enrollment for the year was 110,177 boys and girls in the club work. In the year 1915 cooperative relations were perfected with six additional States; the total enrollment for the year on June 30 was 151,194.

Organization.—The work is carried on cooperatively in 27 of the 33 Northern and Western States through project agreements. Quite generally one-half the salary and traveling expenses of each cooperative leader is paid by the United States Department of Agriculture through the Office of Extension Work North and West, the other half by the State college of agriculture through its State funds or the apportionment of State and Federal Smith-Lever funds. Within the States the club leaders work directly under the supervision of the director of extension in cooperation with the State leaders in county-agent work, county superintendents of schools, specialists and leaders in home economics, extension schools, etc., and so plan their work as to eliminate unnecessary duplication of effort, organization, and work. The leaders, in addition to cooperating with and helping the county agricultural agents in the proper conduct of the boys' and girls' club work in their respective counties, also work with the departments of education, normal schools, agricultural high schools, and public schools, and through the schools make arrangements for the organization and direction of boys' and girls' clubs.

Results.—During the calendar year ending December 31, 1915, 209,178 boys and girls were organized into club groups and enlisted in the regular boys' and girls' work; 127,882 of this number did all

the regular home-project work, as required by the leaders; 82,264 of these made attested reports on the regular blanks furnished for the purpose and completed all the work of the season or year, which was 40 per cent of the total enrollment and 64 per cent of those who did all the home work but who failed to report in full. Out of the total number who completed all the work, 24,299 boys and girls were engaged in what may be termed profit-making projects, from which they produced $509,325 gross of food products. The total cost of the work for overhead supervision from all sources—local, State, and Federal—was $95,076.01, thus showing a per capita administration cost for the work of 45 cents, while the production value per member was $20.96. Basing the per capita administration cost of the work upon those only who completed *all* the work and made the crop reports required, it would be $1.15. Many of the boys and girls who were enrolled in the club work and who were not able to do the home-project work nevertheless were members of the club groups, met monthly or bimonthly, studied the lessons, participated in the discussions, and received the instructions from the State leaders in connection with the work, and most of them did part of the work, but for various reasons failed to complete the work and render reports.

The State leaders in the boys' and girls' work in addition to their own direction of details of the work secured 11,478 local volunteer leaders who assumed cooperative leadership with them of the groups and helped the paid leaders in local follow-up work, such as holding group meetings, visiting club plats, conducting demonstrations, and assisting in keeping up a live active interest in the work during the hot summer months. The cooperative paid leaders of the 27 States conducted 1,670 canning demonstrations for the training of club members in the art of home canning and for the saving of surplus fruits and vegetables; the total attendance at these canning demonstrations was 156,580. In addition to this the same leaders conducted 3,829 field meetings, and personally visited 27,733 club plats to give instruction and encouragement to members. During the past calendar year they prepared and distributed 2,108,456 pieces of follow-up instructions or directions in the support of the work. The United States Department of Agriculture through the office of extension for the North and West supplemented this amount with 1,140,146 circulars, multigraphed sheets of instructions, etc.

Outlook.—The boys' and girls' club work as an agency in extension work is clearly recognized as of great value in all the Northern and Western States. The temporary features, such as prizes, contests, and exhibits, are more and more being subordinated to the more substantial features of the work. Permanent plans and organization looking toward the future development of the work are

apparent everywhere. Boys and girls are enrolling in club projects, not as a temporary or make-shift enterprise, but with the thought of pursuing the work for a series of years and mastering in a broad way the things that constitute good farm and home management.

FARM-MANAGEMENT DEMONSTRATIONS.

In 1912 when the county-agent movement was new in the Northern and Western States and the agents were trying to determine the best way to go at their work, several county agents, encouraged by the Office of Farm Management, of this department, and particularly the agent in Chemung County, N. Y., decided to conduct farm-management surveys in their counties to enable them to know with some certainty the agricultural conditions that most vitally affect the profits of farming in their regions. It was recognized from the start that such work as this was investigational and that the relatively few records the county agent would be able to take in connection with his other work must be retaken for the same farms a number of years in succession before any accurate conclusions regarding farm organization in that section could be drawn from them. Therefore, no early results from the work were expected. However, before the work had proceeded far, it became evident that even with records covering the business of but a few farmers and for a single year it was possible to demonstrate the local application of some of the better established farm-management principles. It was also found possible by the use of these records to compare the business of farmers in a community and to point out to each of them how he stood in comparison with the more efficient of his neighbors, and thus stimulate him to greater efficiency in connection with the parts of his farm business where weaknesses were manifest. But what is of more importance, the agent by means of these records was able to impress upon farmers the need of thinking of their farms with regard to net income secured for their year's work rather than from the standpoint of yields alone, and of making a thorough study of their own business as a means of making it more profitable. It was from this point of view that farm-management demonstrations were officially launched by the Federal Government in 1914 in cooperation with the various States. As a result, $50,500 were spent in conducting farm-management demonstrations during the fiscal year 1914–15, mostly from Federal sources.

From the standpoint of money expended, farm-management demonstrations have tenth place as an extension project.

Cooperative relations.—The work of all the county agents or local leaders who are conducting demonstrations of this character has been supervised in each State by one or more State farm-management demonstrators, who are cooperatively employed by the State agri-

cultural college, and the States Relations Service of the Department of Agriculture.

Farm-management demonstrations are conducted by the county agents with the approval of the farmers with whom they are working and with the assistance of other local leaders, such as teachers of agriculture in the high schools. Sometimes, in the absence of a county agent who is interested in the work, it is taken up by some of these other local leaders independently.

The administration of this demonstration work in each State is vested in the State extension director, who is employed by the State agricultural college. The work is closely coordinated with the department of farm management in the State agricultural college and with the Office of Farm Management of the Department of Agriculture, and these divisions are held responsible for the subject matter taught.

Methods of work.—Demonstrations of this character are launched in a county by taking farm-analysis records of a small number of farmers, usually 50 to 100, who are farming under similar agricultural conditions. These records are summarized to determine which of the farms are more profitable, and then they are analyzed to determine why some farmers are securing greater incomes than others. With this information in mind, the county agent consults with each of these farmers, showing him his relative standing in the community and just how the summary and analysis are made. If the farmer desires, the agent undertakes to assist him in determining upon changes in his farm business that will make it more profitable, at the same time urging him to keep a more accurate record of his business the succeeding year and showing him how to keep this record. Farmers in the community in which the demonstration is being conducted are brought in touch with its summarized results through press articles, meetings, and personal conferences, and are encouraged to keep a similar record of their business. At the end of the year all farmers who have kept a record of their business are assisted in summarizing their records to learn how profitable their business has been, and then in analyzing them to determine why they have not had greater incomes.

Records to show business management.—The farm-management demonstrations are of special value in connection with county-agent work, because they teach the county agent to conceive of his work as a means of increasing the efficiency of the entire farm rather than of increasing its productions along but a few lines. Having done this, he is instructed through these demonstrations in the use of a simple method whereby he may teach farmers to think of their business from this same standpoint, and then teach them how they themselves may analyze their own business and determine means of making it more profitable.

The extension specialist in subject matter finds these demonstrations of much value to him in his work, because through them he is able to convince farmers of the importance of his specialty more effectively than in any other way. They also serve in some cases to help the specialist get a better understanding of the relation of his work to the economic improvement of the farms with which he comes in touch. In some States these specialists are already finding it to their advantage to go out with the farm-management demonstrator and take regular training in farm-analysis work. In other States specialists' projects are drawn in such a manner that the success of their work is to be measured by the increase in income secured by the farmer from his entire farm through improvements along the line they advocate rather than by increase in yields or income secured alone from their special enterprise.

Progress and results.—Farm-management demonstration work was taken up by five States in cooperation with the Federal Government in September, 1914, the training of men for the duties of State farm-management demonstrator beginning the preceding July.

At the close of the calendar year of 1915 work was under way in 22 of the 33 Northern and Western States in 147 areas. Eleven thousand nine hundred and ninety-one farm records had been taken, 390 meetings held, and 6,053 records returned. One thousand one hundred and ninety-five farmers planned to reorganize their business, and follow-up work was arranged for with 1,159 farmers, while 1,553 farmers had agreed to begin to keep some system of farm records.

TABLE XVII.—*Farm-management work at the close of Dec. 31, 1915.*

State.	Areas.	Records.		Farmers planning reorganization.	Farmers beginning accounting systems.	Follow-up work.
		Taken.	Returned.			
Colorado	8	458	.....	.....	.....	.....
Connecticut	6	490	242	68	53	92
Delaware	3	166	63	63	61	113
Illinois	3	198	63	.....	.....	.....
Indiana	10	757	373	180	28	130
Iowa	5	365	260	4	182	7
Kansas	7	715	479	1	35	18
Maine	5	470	622	56	.....	17
Massachusetts	8	945	478	50	1	241
Michigan	7	773	618	38	10	18
Minnesota	10	721	338	.....	480	.....
Missouri	2	116	192	2	16	.....
Montana	7	350	158	23	16	9
Nebraska	12	663	264	7	101	.....
New Hampshire	6	450	172	95	110	208
New York	20	2,092	778	61	55	107
Ohio	5	524	17	16	23	.....
Oregon	2	101	.....	.....	.....	.....
Utah	6	367	367	302	308	34
Vermont	6	456	236	137	73	57
Washington	6	671	254	25	1	108
Wisconsin	3	143	79	67	.....	.....
Total	147	11,991	6,053	1,195	1,553	1,159

As soon as the object of the work and the method of conducting it are thoroughly understood, it seems to meet with prompt approval. Farmers who in some cases question the advisability of demonstrations for the purpose of increasing crop yields approve of this work at once, because its success is measured in terms of dollars per farm instead of in yields per acre or per animal. State extension directors and State leaders of county agents are using the results of this work to show the purpose and value of county-agent work when conferring with counties which are considering the installation of county agents. Teachers of agriculture in the county high schools have been prompt to take hold of farm-management demonstration work. They are finding that it fits in admirably with the agricultual work which they have been teaching and that high-school boys of reasonable maturity who are definitely connected with farms are able to take part in demonstrations to very good advantage.

Outlook.—It would appear that the greatest danger facing farm-management demonstration work to-day is the rapidity with which it is spreading over the country. It is hoped, however, that by carefully restricting the work to demonstrations of well-established principles and to teaching farmers how to study their own business, much good will be done, and that eventually when the records taken are sufficiently mature to justify conclusions being drawn from them by the investigators, still more benefit will accrue to the American farmers.

DAIRYING.

More extension work was done during the fiscal year of 1914–15 in dairying, including work with dairy animals and dairy products, than was done with all other classes of live stock together. As an extension project it ranks eighth, nearly $60,000 being expended.

Extension work in dairying for the past year included chiefly cow-testing associations, bull associations, creamery development, dairy-farm management, and construction of dairy buildings.

Cow-testing associations.—A cow-testing association is an organization of farmers banded together for cooperating in obtaining production and feed-cost records of their cows so that they may increase dairy profits by the elimination of unprofitable cows, the selection of high-producing cows and breeding them to dairy bulls of high merit, and through feeding economically balanced rations. A typical association has 26 members, owns in the aggregate from 400 to 600 cows, and employs a man to secure, keep, and study their records.

The first cow-testing association in America was organized in Michigan in 1905. On June 30, 1915, in the 33 Northern and Western States there were 205 associations in 22 States testing 102,800

cows each month; that is, there were about 5,440 farmers who know through cow-testing associations the amount of milk and milk fat produced by their cows, the value of the product, cost of the feed, and the profit or deficit above feed cost made by each cow during the year.

While a number of the associations have been organized by local farmers who are especially interested, the great majority have been organized through the county agents, State specialists, and field representatives of the dairy division of this department, either working alone or cooperatively. In this work, as in any cooperative enterprise, it is necessary (1) for the farmers to realize the need for the work to be done, (2) to appreciate that an association for this purpose can accomplish the desired results, and (3) to give the association active support.

The funds for operating cow-testing associations are secured by charging members an annual fee per cow, varying from $1.50 to $2, which is used for the purpose of employing an official tester, who keeps the records of the association and aids members in interpreting the records for planning herd management. It is usually necessary that some outside person who is making a special study of cow-testing associations give some oversight to the work of the official tester and assist and advise the directors in conducting association business. In some States the dairy specialist attends to this work, in others the county agent, in others the representative of the Dairy Division, Bureau of Animal Industry of this department, or cooperative assistance may be given by all three.

The Dairy Division furnishes the following indications of progress made:

Records show which cows are profitable and furnish a basis for elimination of unprofitable animals, of selecting breeding stock, of choosing methods of feeding and herd management. Hundreds of illustrations are reported similar to the case of the herd in one State, from which 7 of the 17 cows were sold during the first year's testing, the remaining 10 returning more profit than the original herd of 17. The farmers in another State having 37 associations, out of 16,700 dairy cows, disposed of 3,375 as unprofitable—that is, about 1 in every 5. Using this proportion, of the total number of dairy cows in the United States there are 4,000,000 which are making unsatisfactory returns. In another State knowledge obtained from the records saved the farmers as much as two and a half dollars per month per cow on the cost of feed without reducing the milk flow. One association, which has been in operation 11 years in a community where the average yield of butter-fat production per cow was approximately 140 pounds, has increased the butter-fat production so that the aver-

age per cow for the last three years has been 280 pounds—double that of the herds of the community 11 years ago.

Bull associations.—A cooperative bull association is an organization of farmers for the joint ownership and use of pure-bred bulls. It differs from the community breeders' association in that the ownership and control of the bulls in the bull association is the business of the association and not directly that of the individual members.

The first bull association was organized in 1908. At the close of the calendar year 1915 there were 21 cooperative bull associations in active operation in the 33 Northern and Western States. Plans for organization are based on similar conditions to those discussed under cow-testing associations, except that a smaller number of members may form an association. The plan of work is for the association to purchase three bulls of one breed. Members of the association are divided into three groups or blocks, and at the end of two years the bull from each block is moved along to the next one. Thus the original purchase of three pure-bred bulls gives six years' use of desirable sires on investment for only three animals. The investment of $20 to $60 per member gives that member the use of a registered sire. The great majority of the 22,000,000 cows in the United States are in herds of 3 to 10 cows. A strong feature of the cooperative bull association is that the owners of these small herds are able to have the use of registered sires at a relatively low cost.

This work obviously requires a longer period of time to yield specific results than does the cow-testing association. However, the farmers where these associations have been in operation state that the market value of the offspring of their cows has been increased from 30 to 80 per cent through the use of the association registered sires. In other instances where the bull association has been in operation, there has been a marked improvement in the herds and a decided interest taken in the community in organizing more profitable dairying. The combined interest of the different farmers in the dairy work has led to some other things of value to the community, such as securing agricultural-extension schools, establishing cooperative creameries, building of silos, starting a cooperative store, and cooperating in the selling of milk. However, there are good reasons to believe that the bull association not only can fill an important place in profitable dairying but is doing so.

Creamery work.—Creamery-extension work included assistance in operation and management intended to increase the amount of money received by the farmers. Creamery managers were instructed in making tests for fat, water, salt, acidity; in reducing costs for fuel and labor. Farmers were instructed in methods of improving the quality of their product at minimum costs. This work resulted in

increasing by several thousand dollars the amount paid to farmers, and put a number of creameries on a stronger financial basis so that they can continue to pay farmers more for good-quality products.

Other dairy work.—Other kinds of dairy work included construction of dairy barns and silos, planning cropping systems, dairy-herd feeding and management, and prevention of disease.

Much dairy-extension work has been conducted in the past by the Dairy Division of this department, both independently and in cooperation with the State college authorities. However, the memorandum of understanding provides for a coordination of work in each State through its extension division and thus affords a means for future cooperation in dairy work.

Some States have also been conducting dairy-extension work, a report of which, so far as data are available, will be found under the several States.

Outlook.—The dairy business is in need of the large amount of attention being given it in extension work, for of all farm work this receives possibly the least thoughtful consideration, and very few records are as yet kept by dairymen to locate more profitable cows and methods. Cooperative effort among farmers now being encouraged by extension workers will, it is found, reduce the expense of record keeping, reduce the cost of securing the use of registered sires, and stimulate an interest in dairy problems that will result in greater efficiency and increased profits in dairying.

EXTENSION SCHOOLS.

Extension schools in agriculture and home economics rank as the third extension project in the Northern and Western States when considered on the basis of the amount of money expended ($176,200), ranking after county-agent and administrative projects. Extension schools appear to be of special assistance in developing county-agent work.

History.—Farmers' institutes opened the way for the extension school. Probably the first extension school organized was held in Chautauqua County, N. Y., in 1894, after the grape growers of the county had secured a legislative appropriation for investigation and instruction in horticulture in that county. This type of school was carried on for only a few years in New York, but served as an example which was followed later in other States. From 1897 to 1900 similar schools were conducted in Maine, and 1905 to 1909 saw the extension-school movement well started in the Middle West; and at the time of the passage of the Smith-Lever Act in 1914 extension schools were held in nearly all of the Northern and Western States.

Organization and procedure.—The agricultural extension school is a group of persons organized to receive instruction in agriculture.

This work is usually conducted in local communities where the members of the community have agreed to give the school the necessary moral and financial support to make it a success, and frequently includes work in both agriculture and home economics. There are, in general, two types of extension schools, (1) those in which a general program is followed and numerous subjects more or less closely related to the major topic are taken up; and (2) those in which various subjects are discussed in separate rooms and persons attending may select the lines of work which they desire to follow. In both types an attempt is made to give as much work in form of demonstrations as possible, and in a few States exercises are conducted in which the members of the school participate. The extension school serves not only to give specific instruction in several phases of agricultural work particularly well adapted to the needs of the local community, but also to provide an opening for demonstration work conducted by county agents and specialists. Many States now plan to conduct some follow-up work after the extension schools, and this usually is associated with demonstrations handled by the county agents.

Extension schools are usually conducted during the winter season, for at that time more of the farmers can attend than in other seasons of the year.

At the present time a large portion of the work in extension schools consists of lectures; however, the number of demonstrations given is being increased, and some attempt is made to have the members of the school take part in the exercises illustrating the principles discussed in the lectures. The amount of illustrative material varies from a small quantity to two or more carloads per school. In a few States an effort is made to have much of the illustrative material supplied locally. Extension school workers are finding that the blackboard is of much assistance, and that simple diagrams built up on the board during the lecture sometimes mean more to school members than do more elaborate charts prepared in advance. In some States outlines and syllabi covering work are furnished to the members of the schools; in others special effort is made to present the work in such a way that the members will take notes on the material presented. In still other States a combination of the two plans is used with success.

In many States special attention is given toward inducing the members of the school to discuss between sessions the subject matter presented, and this frequently uncovers methods for local application and does much toward securing successful results, as well as fosters a community spirit of comradeship and a cooperation of effort which opens the way for county-agent work. States which have been conducting extension schools for a number of years have found that

schools from three to five days in length with a program closely related to one particular subject, do most toward stimulating the community to action and open the way for follow-up work.

Most States plan to have the county agent closely identified with schools in his county, so that he may assist the instructors by his knowledge of local needs and conditions, and also that he may plan the follow-up work for which the school opens the way. In some States follow-up work consists of farm demonstrations in crop and animal production, preliminary arrangements being made with the farmers at the school. In other States meetings are held on farms during the summer to further develop the application of principles duscussed at the school. In one State a few of the most interested farmers are induced to report to the county agent the use made by their neighbors of ideas presented at the school and also to arrange with the agent for such demonstration meetings on the lines of the school subject as are most needed to increase economic returns.

Results.—Reports received from 19 States show that 415 extension schools were held during the fiscal year of 1914–15. The average attendance per school was 108, and the total attendance 44,879.

Follow-up work and demonstrations conducted as a result of extension schools are so closely intermingled with other activities of the county agents as to make a separate report impossible this year.

Outlook.—Practically all of the Northern and Western States have during the year adopted some form of extension-school work. Attention is being given by several States toward locating the most efficient methods and best illustrative material for developing schools in their respective communities. Many of these States find these schools to be of exceptional value in opening the way for county-agent work, as well as giving much assistance to its development.

HOME ECONOMICS.

Extension work in home economics ranks fourth in the amount of money devoted to it in the 33 States when funds used in home economics extension schools are not considered separately.

Resident courses in home economics were established in some of the middle western agricultural colleges in the seventies and the women's sections of farmers' institutes followed closely. This extension work continued to grow. At the time of the passage of the Smith-Lever Act in 1914, extension schools in home economics were being held in nearly all of the Northern and Western States. Many of these schools were and are held in conjunction with agricultural schools, the extension-school project holding third place in extension work.

Organization.—In most of the States the extension work in home economics is organized with a leader or supervisor who is usually

the head of the home-economics department of the college; associated with her are extension instructors who devote from three months to the full year of their time giving lectures and demonstrations before women's clubs, farmers' institutes, granges, and at the women's department of the agricultural extension school. The sessions at clubs, institutes, and granges may continue through one or two days, but not infrequently only a single lecture or demonstration is given.

Over $98,000 has been expended during the fiscal year 1914–15 for home-economics work in the Northern and Western States, in addition to the money used in support of home-economics extension schools and in girls' canning-club work.

Procedure.—In the extension schools one or two women conduct lectures and demonstrations during a period of from 3 to 5 days. The programs, arranged in conference with the State leader or supervisor of home economics, include such subjects as cooking meats, baking bread, preparation of starch foods, quick breads, leftovers, pastries; home sanitation; kitchen equipment; and house-furnishing and home decoration.

Equipment which can be carried in a trunk without great danger of breaking is usually furnished by the extension division.

In several States the home-economics department has been cooperating with the county agents and with the State leader of boys' and girls' clubs in conducting work with boys' and girls' clubs and in giving canning demonstrations and suggestions as to the conveniences in the farm home. In Illinois the home-economics extension instructors have cooperated with the small village high schools not having regular home-economics departments. In these schools courses in preparing and serving foods and elementary principles of sewing and laundering have been taught. In Ohio there has been cooperation between the State department of education and the home-economics extension workers in conducting courses in the county normal training schools. The subjects discussed and the demonstrations given were for the benefit of those who are preparing to become teachers in rural and village schools.

In a few of the States formal application is required for service extending over periods of from three to five days. The application bears the names of from 10 to 25 women who guarantee to provide a suitable room for the lectures and demonstrations, entertainment for the instructors, and demonstration material which usually includes a portable stove and necessary groceries. The signers of these applications usually agree to give publicity to these meetings and to bear the local expense.

In Iowa tours are made by automobile and by other conveyances to visit homes in which improvements have been made during the year. The plan and cost of installing or remodeling is explained

by the housewife, while the farmers who have accompanied their wives are observing the improvements made in farm buildings and other things about the farmstead.

For two months out of the year a project in home economics was conducted in Utah, including demonstrations, conferences, and 72 home visits, for the purpose of giving instruction in household equipment and methods in preservation, preparation, and serving of foods and in the various other problems of home management. Similar work was conducted at Brimfield, Mass., from April 1 to June 30, 1915.

The demonstration work in home economics is perhaps one of its strongest features. The fact that most of the work, such as the preparation, preservation, and serving of food, the making or remodeling of clothing, and the most approved practices in laundering, can be conducted within doors makes possible the conducting of demonstration work far beyond that which can be usually conducted on agricultural subjects. Methods or recipes prepared in multigraph form for those who attend the meetings lessen the work of note taking.

Definite well-planned follow-up work is needed to establish the methods discussed or the demonstrations made in the schools.

Results and outlook.—Three hundred and thirty-five home-economics extension schools were held during the year, with an attendance of 21,304, an average of 63 women per school. This being one of the newest phases of extension work to be undertaken in a large way, it is hardly to be expected that a definite statement of results can be made.

Methods of instruction are being standardized; plans for follow-up work are being strengthened; the importance of accurate records has been emphasized; and, with the knowledge gained as to the work which farm women desire to have done, the home-economics instruction promises to become one of the most fruitful fields for extension service.

STATE REPORTS.

ARIZONA.

Division of Extension, College of Agriculture, University of Arizona, *Tucson.*

STANLEY F. MORSE, *Director.*

History.—Farmers' institutes began in Arizona in 1895, the first meeting being held at Phoenix in response to a call issued by the agricultural experiment station and the Phoenix Chamber of Commerce. A similar meeting was held in 1898, also at Phoenix, and in 1899 eight farmers' institutes were held in various sections of the Territory. Since 1897 the holding of farmers' institutes has been a

regular feature of agricultural-extension work in Arizona. Until 1903 the entire expense of holding these institutes was borne by the university and the agricultural experiment station. In 1903 the legislative assembly made an appropriation of $2,700 for the purpose of holding "farmers' institutes and short courses of instruction" throughout the Territory. The agricultural experiment station has been very closely related to extension work, and the director of the experiment station was placed in charge by the board of regents of the university. The legislature has made appropriations annually in support of the work.

The principal extension activities up to the fall of 1913 were in the nature of farmers' institutes, the running of an agricultural-demonstration train, conducting of farmers' short courses, and miscellaneous advisory service. Previous to the organization of the extension work under the terms of the Smith-Lever Act there had been the Arizona Farm Improvement Association, which is a voluntary State organization of about 500 farmers, having subordinate organizations at 18 points, mostly in the southern part of the State. The association was organized to develop a better agriculture, secure market facilities, buy cooperatively farm and home supplies, and to promote fairs, institutes, and county-agent work.

The assent of the governor to the terms of the Smith-Lever Act was given on May 19, 1914. The State legislature accepted the provisions of the Smith-Lever Act by the passage of Senate Bill No. 34. This bill, which was approved by the governor March 9, 1915, automatically provides funds to offset the increases from year to year of the Federal funds. By the terms of this act the University of Arizona is designated as the institution to administer the extension funds in the State.

Organization and administration.—The extension division is organized as a distinct department of the college of agriculture of the University of Arizona. The extension director is administratively responsible to the dean of the college of agriculture. The members of the extension staff are administratively responsible to the extension director. As regards subject matter, they are responsible to the heads of the departments of instruction in the college with which their work is associated. Four members of the staff, including the director, devote their entire time to extension work. One devotes more than half time and eleven less than half time. Direct cooperation with the United States Department of Agriculture is maintained in county-agent work and boys' and girls' club work, the department contributing funds in support of these projects.

Publications.—During the year, miscellaneous publications were issued including the first annual report of the extension service.

These publications deal chiefly with animal-husbandry work, in addition to the weekly press letters.

Many of these publications have been issued in small quantities and in mimeograph form. The attempt has been made to supply the immediate demands for information along special lines. The Weekly Press Letter was started in October, 1913. Copies are sent to every publication in Arizona and to the leading daily and agricultural papers of the United States. It is sent regularly to members of the Arizona Farm Improvement Association.

Finances.—During the fiscal year, 1914–15, the amount and sources of funds entering into extension work in agriculture and home economics were as follows:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	1,858
State appropriation	4,440
County appropriation	350
From other sources within the State	1,000
Total	17,648

A detailed financial report showing the expenditure of the above funds by schedule and projects has been received and approved.

Smith-Lever funds have been used in developing the following projects: Administration, live-stock extension, county agents, boys' and girls' clubs, and the general advisory service. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents and boys' and girls' clubs.

SMITH-LEVER PROJECTS.

County agents.—County-agent work began December 16, 1914, with the appointment of an agent for Cochise and Santa Cruz Counties; a second agent began work March 1, 1915, in Maricopa County.

These agents have been engaged in developing organizations to secure the general adoption of successful farm practices followed by a few of the older settlers. They have been advocating the production of such farm products as are needed for local consumption and have endeavored to secure information regarding markets for the surplus.

A series of demonstrations dealing with pit silos, forage crops, crop rotations, cultural methods, orchards, gardens, and live stock are being undertaken. Farmers who agree to act as cooperators in this work sign agreements. Twenty-six demonstrations were undertaken in 1914–15 as follows: (1) Cooperative seed breeding; demonstrators who grew corn, wheat, feterita, kafir, and tepary beans.

(2) Cooperative seed raisers; 19 farmers received seed and 17 rendered a report on their results. Several of the demonstrators sold fancy seed to other farmers or seed houses. Fifteen farmers' organizations have been formed, including purchasing and marketing associations, a cow-testing association, and a county farm bureau; 190 farmers have undertaken cooperative demonstrations; the agents have assisted in securing information whereby the farmers found a market for $5,500 worth of farm products; 854 farm visits were made by the agents; they have also assisted the State leader of boys' and girls' clubs to organize 12 clubs.

In Maricopa County the agent reports securing the signed agreements of 138 farmers to treat with London purple under his direction the ants' nests found on 9,000 acres.

Boys' and girls' clubs.—The State leader of boys' and girls' clubs began work January 1, 1915. Previously 24 clubs had been formed; as a result of his work for six months 38 clubs, representing a membership of 284, have been organized. During the same period 27 canning demonstrations had been conducted as a part of the work given on a demonstration train. Clubs have been formed in one-half the counties of the State.

Animal husbandry.—In Maricopa County there was formed one cow-testing association having a membership of 47 persons owning over 600 cows. Live-stock specialists advised with rangemen about the care of their cattle and sheep and encouraged them to secure better stock, and emphasized the advantage of the development of swine husbandry in the State by the use of better sires and by proper feeding. Seventy-six meetings were held. In addition, 10 demonstrations have been given in the construction of hog houses, movable shade, and fences.

OTHER EXTENSION WORK.

An agricultural-demonstration train was run 2,060 miles and was met by 19,000 people at 32 stops. It is believed, however, that the same investment would bring greater returns if spent in other lines, and probably this work will not be continued.

Extension schools.—The third annual farmers' short course was held January 4 to 16, inclusive, 1915, with a registration of 143. For the first time lectures on home economics were given.

Farmers' institutes.—Fourteen institutes were held in 1914–15, with an attendance of 1,543. It is expected that as the Arizona Farm Improvement Association, organized in 1914, extends its local branches throughout the State, the monthly meetings will be addressed by farm advisors or extension specialists, so that the work formerly done by institutes will be done more effectively by the new agency. During the year 1914–15, at 130 meetings of the

subordinate Farm Improvement Association, there was an attendance of 5,005.

Horticulture.—Work in horticultural extension has been carried on by the horticulturist of the experiment station through visits, lectures, correspondence, press articles, and by field and cooperative demonstrations of laying out, planting, and pruning orchards. During the year the specialist in horticulture visited 50 fruit growers, held 18 meetings, and arranged 4 farmers' cooperative demonstrations in Clarkdale, Tucson, Sonoita, and Portal, showing proper methods of planting, pruning, using fillers, and sowing cover crops.

Agronomy.—The specialist in agronomy was in the field from March 25 to May 11, 1915. During that time he visited 173 farmers, addressed 3 meetings, and secured information concerning the newly started sugar-cane industry in the Salt River Valley.

OUTLOOK.

The work of the county agents has apparently been one of the most effective projects. With the scattered communities and expense of travel the development of the county-agent system with the man located in a restricted area seems most promising in securing results. It is understood that specialists will be added to the extension staff as funds are available, and these specialists will give their major efforts to work with the county agents.

CALIFORNIA.

Division of Extension, College of Agriculture, University of California, *Berkeley.*

WARREN T. CLARKE, *Director.*

History.—There is no State department of agriculture in California. Farmers' institutes were therefore initiated and actively participated in by members of the university faculty from the time of its establishment in 1868. In 1897 the department of university extension in agriculture was established at the university and institute work continued by this department. The professor of agricultural extension, who is at the head of all extension activities, is also superintendent of farmers' institutes. In 1904 reading courses were introduced as a portion of extension work and books in the form of circulating libraries were furnished to farmers enrolling in these courses, their reading and study being supervised by the extension division. In 1913 correspondence courses were established in the division of agricultural education, superseding the reading courses. Agricultural trains have been handled during the past 10 years, and many members of the university faculty have visited individual

farms and attended frequent meetings called at the various experiment farms in the several sections of the State in order to become familiar with farm conditions and also the adaptation of scientific information to the art of agriculture.

The governor gave his assent to the Smith-Lever Act prior to July 18, 1914, and the legislature accepted the terms of the act of April 27, 1915.

Organization and administration.—The director of extension under the title of professor of agricultural extension has general supervision of all extension matters. He is assisted by an assistant professor of agricultural extension, who is county-agent leader, and also State leader of boys' clubs and boys' pig-club work. Another assistant professor of agricultural extension is in charge of farmers' institute work and is largely responsible for the personal visitation work done by members of the division. An assistant professor of agricultural extension is in charge of extension-school work. Another assistant is in charge of farm-home management and demonstration work. The State leader of boys' clubs has an assistant giving his attention to boys' clubs and another to pig-club work. Eleven county agents, called county farm advisers, are in charge of work in their several counties and report directly to the county-agent leader.

All officers and assistants in agricultural extension are regular regents' appointees of the college of agriculture of the University of California, and as such are members of the faculty. Twenty-six persons give their full time to extension work, and 15 persons give less than half time.

Publications and mailing list.—The extension division issues no publications, but extension publications are issued both by the college of agriculture and by the experiment station. The experiment station has an extensive mailing list, which, in desired cases, is supplemented by a special extension mailing list.

Finances.—The following amounts were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000.00
United States Department of Agriculture, farmers' cooperative demonstration work	5,992.00
State appropriation through college	27,529.00
County appropriation	22,000.00
Total	65,521.00

Smith-Lever money was used entirely in the support of county-agent work. A detailed financial statement has been received and approved. The United States Department of Agriculture has cooperated by furnishing funds for the support, in part, of the following projects: County agents' and boys' and girls' club work.

SMITH-LEVER PROJECTS.

County agents.—Agents were located in 4 counties at the beginning of the year 1914–15 and in 11 counties at the close. The organization of county-agent work is quite different from that in most of the Western States. The initiative for and organization of the county arises within itself, as the university does not approach a county until a farm bureau has been organized and at least one-fifth of the farmers in the county are enrolled as members, each member paying $1 a year dues. The county board of supervisors appropriates $2,000 for the expenses of the farm adviser and agrees to maintain this appropriation for at least three years. When these things are done the University of California and the United States Department of Agriculture jointly appoint the county agent, pay his entire salary, and supervise his work, funds being available from the Smith-Lever appropriation, State appropriation through the college, and United States Department of Agriculture, besides those mentioned above.

Each county is divided into numerous farm-bureau centers, which are visited in turn regularly by the county adviser. At this time he visits farms whose owners have requested the local farm-bureau-center manager to have the adviser call.

During the year the agents made 9,106 farm visits to 4,652 different farmers. They held 1,458 meetings, with a total attendance of 64,419. Twenty-one associations were organized for adults, including live-stock breeders' associations, cow-testing associations, antihog-cholera associations, purchasing and marketing associations, and farmers' exchanges.

OTHER EXTENSION WORK.

Two extension schools were conducted, with an attendance of 862. Twenty-six 3-day and thirty-three 2-day farmers' institutes were held, with a total of 164 sessions and an attendance of 10,441. One hundred and forty meetings were addressed by one representative, with a total attendance of 15,610.

By law the director of extension is also superintendent of farmers' institutes, so that all this work is handled through the university.

Home economics.—The farm home-management project has for its objects "the development in the farm home of methods of preventing farm wastes, overcoming drudgery in the farm home, and overcoming isolation." Work is done through farm centers and also in cooperation with the agricultural betterment clubs where these have been established. "Projects covering county advisory work and farm home-management work are so closely interrelated that they seem to be a part, one of the other, in the organized counties." It is estimated that 20,000 women are directly interested in the work.

Boys' clubs.—Seventy-one clubs, with 684 members, were organized for the following projects: Corn, potato, market garden, alfalfa, poultry, pork production, and home garden; 554 members completed their work; 250 winners were given a State tour, and 29 of the higher winners were given a 9,000-mile trip through the United States, Canada, and Mexico.

OUTLOOK.

In California, as well as other Western States where great diversity of climate, soils, and marketing conditions prevail, the need is pressing for more survey and research work which shall place in the hands of extension agents accurate local information for extension. The county-agent work seems to be founded on a basis of permanency. The farm-bureau centers with day farm visitation and night meetings make the work unusually strenuous for the agents, a condition which will no doubt be modified as the work becomes more thoroughly organized.

The club work is organized at present primarily with boys in the high schools. A good grade of work is being accomplished with the limited numbers reached, though the prizes offered in the transcontinental tours would seem to be out of proportion to the efforts of the winning members. Work with the girls and younger boys, as well as the club activities in the more strictly rural districts, is yet to be developed.

COLORADO.

Division of Extension Service, State Agricultural College, *Fort Collins.*

CHARLES A. LORY, *Acting Director.*
[H. T. French, appointed in August, 1915.]

History.—The State board of agriculture (board of trustees of the State college of agriculture) was organized March 19, 1877. On November 26, 1879, a meeting, which was of the nature of a farmers' institute, was held at Fort Collins, in the management of which the local organization and State board of agriculture cooperated. From 1888 to 1891 the State board of agriculture defrayed the expenses of professors participating in farmers' institutes. In 1892 the general assembly appropriated $500 to defray the expenses of institute lecturers. During the period from 1888 to 1904 from 6 to 20 institutes per year were held. In 1904 the legislature appropriated $4,000 for the purpose of organizing and conducting farmers' institutes each year in agricultural counties and made it the duty of the State board of agriculture to organize and conduct them. The agricultural extension service of the college of agriculture was organized in 1910,

but field work was not developed on account of limited funds. In October, 1912, the first county-agent work was begun in Logan and El Paso Counties in cooperation with the United States Department of Agriculture. In 1913 the general assembly enacted a law enabling the county commissioners to appropriate public funds to employ county agents, subject to the approval of the State board of agriculture which was authorized to issue certificates of competency. Boys' and girls' club work was first organized in the spring of 1910. On June 5, 1914, the governor assented to the terms of the Smith-Lever Act and on April 9, 1915, the terms of this act were accepted by the general assembly.

Organization and administration.—The president of the agricultural college was acting director of the extension division for 1914–15. On November 1, 1914, an assistant director was appointed. The extension staff consisted of a county-agent leader, a State leader of boys' and girls' clubs, and an assistant leader of boys' and girls' clubs, whose additional duty was to take charge of all exhibits. In addition to these leaders, there are three specialists—one in farm-management demonstrations, whose work is being conducted in cooperation with the United States Department of Agriculture; one in home economics; and one in rural education. The latter two are paid from State funds alone. In addition to those employed as full-time extension specialists, seven persons on the staff of the agricultural college and experiment station gave much of their time to extension service. Most of the correspondence concerning advice and assistance was carried on with the teaching force of the college of agriculture. Each person whose service was sought kept a careful record of all the work done, letters and news notes written, which was reported to the acting director. Farmers' institutes are conducted by the extension division.

Publications.—One bulletin announcing the extension work of the college of agriculture and four giving practical discussions on agriculture and home economics were published on Smith-Lever funds. Most of the money appropriated by the State was used to develop the work of the rural-education specialist. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, and farm-management demonstrations.

Finances.—The funds available for extension work during the year follow:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	9,883
State appropriations	1,440
County appropriations	8,364
Total	29,687

Smith-Lever funds were used in developing the work of the county agent, the boys' and girls' clubs, and home economics.

A detailed financial statement has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—By July 1, 1914, 12 counties were organized and 8 county agents employed. By June 30, 1915, 13 counties were organized, with 8 county agents. One group of five counties in the San Luis Valley employs one county agent. County-agent work is supported by Smith-Lever, United States Department of Agriculture, State, county, and other funds from within the State. In Morgan County there has been developed a federation of organizations in support of county-agency work. Each county or group of counties employing an agent has conditions which make problems necessitating different methods of procedure. In some counties the funds to support the work of the county agent were supplemented by those of business-men's organizations and the railroads.

The great diversity of climatic and soil conditions has prevented the formation of a general State-wide plan of work to be followed; even approved practices in one county had to be modified very much to be used in an adjacent county. Two counties have consented to deposit their funds for county-agent work with the State college of agriculture, to be disbursed and accounted for by the college treasurer. This plan has also made it possible for the college to direct more carefully the expenditure of all agricultural-extension funds. The expense for travel has been made necessarily large on account of the isolated farming communities.

In the counties with agents 58 different kinds of demonstrations were carried on. The county-agent leader visited 5,568 farms and has held 583 meetings, with a total attendance of 32,865.

Boys' and girls' clubs.—In the boys' and girls' club work the State leader and his assistant had the support of the county agents, who were especially active in El Paso, Logan, and Pueblo Counties. In El Paso County alone there are 35 clubs, with a total membership of 300. The organizations are well distributed over the county. Poultry, corn, pig, potato, canning, sewing, and baking clubs have been organized in 24 counties, with a total membership of 2,700. There have been 38 canning demonstrations conducted at which the attendance was 2,100. Two hundred and fifty thousand pages of instruction have been distributed among the members of these clubs. These instructions were intended as a feature of follow-up work quite as much as for immediate use. This work has been well developed as a club feature. The great variation in soil and climate made State-wide contest work practically impossible. Contests have not been

made to outweigh the results that come from properly supervised club work.

Home economics.—One woman gave her full time to this project. She was occasionally assisted by other members from the home-economics department. Lectures, the judging of products at fairs, a few demonstrations at extension schools and at women's clubs, and replying to inquiries by correspondence engaged her for most of the year.

OTHER EXTENSION WORK.

No money was appropriated by the general assembly for the support of the farmers' institutes as had been done for many years previous, but institutes were conducted by the extension division during 78 days, at which there was a total attendance of 9,036 people. With the assistance of three outside persons, the 24 members of the extension force conducted all the work. In this, as in the county-agent work, the item of expense has necessarily been very heavy.

In July, 1910, the work in rural-school betterment was begun by the appointment of a committee on rural education. The 1913 general assembly made an appropriation of $5,000 with which to conduct this work. A rural-school visitor was employed to begin work October, 1912. The principal object was to introduce agriculture into the public schools, reorganize the rural-school districts, to consolidate districts in sparsely populated country, and to recommend books on agricultural subjects. He visited 21 counties, attended 168 meetings, and addressed 17,576 persons. As a partial result of his work nine weak schools were combined into three consolidated schools. The school survey for 1914 was also completed.

Specialists.—Seven members of the college and station staff gave personal instruction, visited farms, and attended agricultural meetings, in most instances upon the invitation of county agents. The instructor in agronomy reports making nine trips to deliver extension lectures. He spent two weeks also in the field, examining crop conditions, in which work he was assisted by two students. One thousand seven hundred and fifty letters were written in reply to inquiries made to his department. The head of the dairy department reports having assisted in the forming of creamery organizations and in the building of pit silos. The head of the horticultural department has visited the farms of fruit growers, especially in the northwestern part of the State, and has assisted in conducting pruning and spraying demonstrations and in forming cooperative fruit-growing organizations. The department of botany and forestry has assisted in tree planting, tree pruning, and in securing the adoption of the best methods to prevent forest fires. The department of entomology has assisted the county agents in their spraying demonstra-

tions. The head of the veterinary department has attended 14 farmers' institutes and a number of hog-growers' associations and has given some time to the extermination of hog cholera in the San Luis Valley. During the year he has written over 2,000 letters in answer to inquiries concerning live stock. The civil and irrigation engineer has delivered lectures at farmers' institutes and has assisted in the forming of one drainage district.

Farm-management demonstrations.—In May, 1915, farm-management demonstrations were begun in cooperation with the United States Department of Agriculture, and in the few remaining weeks of the fiscal year 365 farm-analysis records were made.

OUTLOOK.

The year has been one of considerable reorganization and adjustment. An extension director has been employed to give his whole time to the work, and he has recently been reinforced with a leader to administer the county-agent work. The county-agent idea has had a steady growth and has been generally accepted over the State as an effective form of extension work which reaches the farmer continuously and directly throughout the year.

CONNECTICUT.

Division of Extension Service, Connecticut Agricultural College, *Storrs.*

H. J. Baker, *Director.*

History.—The establishment of the State Agricultural Society in 1852 was followed by the organization of the State board of agriculture in 1866. The State board laid the foundation for the farmers' institutes as they were conducted until 1914. It held three-day meetings in which dairying, fruit culture, or good roads was the central point of interest; one-day meetings were held at small villages in order that farmers might attend the meetings near home. In recent years most of the farmers' institutes have been held upon the invitation of the Grange.

In January, 1912, a man was employed for farm advisory work by the State Agricultural Society. When the society funds were exhausted this work was taken by the newly-formed agricultural extension department at the college.

This extension department of the college was officially organized in January, 1913, with a director who also acted as State leader of county agents, as a State appropriation of $5,000 had been made to carry on this work. The director and State leader of county agents, a part of whose salary was paid by the Office of Farm Management of the Bureau of Plant Industry under a memorandum

signed January 13, 1913, developed plans in preparation for county-agent work. The first county agent began work in New London County on April 27, 1914.

Boys' and girls' club work had been conducted by the State board of agriculture for about three years. In March, 1914, this work was transferred to the extension department of the college of agriculture, and a man who had been agricultural supervisor for the State board of education was appointed State organizer for the college and collaborator in charge of boys' and girls' clubs for the United States Department of Agriculture.

The terms of the Smith-Lever Act were assented to by the governor on June 2, 1914, and on March 16, 1915, a law authorizing the trustees of the college of agriculture to accept grants of money appropriated under the Smith-Lever Act was passed by the State legislature.

Organization and administration.—On July 1, 1914, the extension department was organized as a distinct department of the college, coordinate with the experiment station. There is a director who reports to the president of the college and who is responsible for the administration of all the extension work and to whom the extension staff reports weekly; there is also an assistant county-agent leader who serves half time as farm-management demonstrator; the State leader of boys' and girls' clubs supervises the teaching of agriculture in the towns of Mansfield, Franklin, and Lebanon. He outlines courses of instruction in agriculture, which may be used by the teachers of the rural schools, and visits these schools once in two weeks, spending a short time in each school. He is employed cooperatively by the State board of education, the United States Department of Agriculture, and the State college of agriculture. The assistant State leader of boys' and girls' clubs gave all of her time to canning demonstrations for girls. Other members of the extension staff are specialists in dairying and in poultry husbandry. A farm adviser who was formerly employed by the State agricultural society has been brought into the extension department. Five county agents were employed during the year.

Members of all the departments of the college and station cooperate in conducting farmers' institutes, in organizing demonstration work, and in assisting county agents in their work. The head of each college department is responsible for the teachings of the extension representative of that department.

Publications and mailing list.—Smith-Lever funds were used in publishing 8 bulletins, of which 3 were concerning boys' and girls' clubs and scoring exhibits, 2 on dairying, 1 announcing farmers' institutes, 1 on the work of the county agent and 1 discussing potatoes as a cash crop. About 4,000 names are now on an unclassified mailing

list. All correspondence relating to extension work is sent to the extension director's office. The letters are distributed by him to the specialist in the particular line to which they refer. No discrimination is made as to whether or not the specialist to whom a letter is sent is a member of the college, experiment station, or extension staff. All letters are filed in the office of the specialist to whom they are referred.

The director's office is in a building separate from those used for classrooms and laboratories.

Finances.—The extension-department funds were derived from the following sources:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	6,101
United States Department of Agriculture, Bureau of Animal Industry	550
State appropriations	5,000
Other sources	5,000
Total	26,651

The bookkeeping is done by the college accountant. The requisitions used in making purchases are approved by the director, and purchases are made by the college purchasing agent.

A detailed financial statement has been received and approved. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, and cow testing and dairy farming. Smith-Lever funds were used in support of the following projects: Administration, county agents, boys' and girls' clubs, poultry husbandry, and dairy husbandry.

SMITH-LEVER PROJECTS.

County-agent work.—At the beginning of the year 1914–15 one agent was employed and during the year four more agents were added, making agents in five of the eight counties in the State, supported by funds from Smith-Lever, United States Department of Agriculture, State and county sources. The State law provides that when the county farm-bureau organization raises $1,000 in any manner that seems best to the bureau, the State appropriates a similar amount for the conduct of county-agent work within that county. The college of agriculture also used $500 from Smith-Lever funds and the United States Department of Agriculture provides $600 in each of four counties, and $500 in the fifth.

The county agent is recognized as being in charge of all agricultural extension in his county and practically all arrangements for extension work are made through him.

The five county agents have visited 1,640 farms and either directly or on the suggestion of the agents the following has been accomplished: Farm buildings improved, 54; silos constructed, 7; crop rotations planned, 110; drainage systems planned, 16; farmers induced to select seed corn in the fall, 4; oats grown following the agents' instructions on 16 farms; potatoes treated for scab on 5 farms; hay grown as directed on 7 farms; alfalfa grown as suggested on 39 farms; alfalfa seed inoculated on 55 farms; orchards cared for, 14; registered animals purchased on recommendation of the agent, 52; cows tested for milk production through cow-testing associations, 1,899; cows tested by individuals on the suggestion of the agent, 782; farms on which balanced rations figured by county agent are known to have been adopted, 39; farmers induced to keep accounts by county agents, 81.

Boys' and girls' clubs.—About 3,000 members were enrolled, and over 1,100 completed all work, the chief projects being corn, potato, and garden and canning clubs.

Dairying.—The leader or specialist in this project has been answering calls for assistance from county agents in securing information which will help farmers to locate better markets and in organizing cow-testing and pure-bred bull associations. A plan has been developed by which bulls are furnished from the college herd to a limited number of communities within the State. They are available in approved herds only. The most effective work done during the year has been furnishing assistance to county agents in organizing cow-testing associations, and furnishing information to those who are members of the associations. Assistance has been received from the United States Department of Agriculture, Bureau of Animal Industry.

Poultry.—The most effective work under this project has been in connection with demonstrations for the eradication of white diarrhea. By testing the blood of a hen it is determined whether or not she contains the germs of the disease, so that healthy breeding stock can be selected with certainty. Eighteen thousand birds had this test applied last year. A charge of 5 cents per bird has been made to cover laboratory expense. Over $900 worth of orders are on file at the newly established price of 10 cents per bird. This work promises to become self supporting.

Farm-management demonstrations.—The United States Department of Agriculture is cooperating in conducting the work under this project. It was carried on by a leader who enlisted the assistance of the county agents; 449 records were taken in the 6 counties and 154 have been returned; 67 farmers have planned to make changes in accordance with the suggestions and 39 have kept accounts as a result of this work.

OTHER EXTENSION WORK.

In addition to the work done under the cooperative projects, there was employed on a per diem basis a practical farmer to advise with reference to rotations and cropping systems. Calls for his services came through the director, to whom he reports the advice given and the results of his visits.

Farmers' institutes.—The farmers' institutes were conducted on State funds. The college contributed $750 and the State appropriated $865.20. During the year 32 institutes were conducted with an attendance of 1,992. Fifteen lecturers from the agricultural college and extension division took part; 17 additional persons assisted in conducting this work.

The extension director is conducting the farmers' institutes, assisted by an advisory board made up of the president of the college, the director of the extension division, the secretary of the State board of agriculture, and the secretaries of various State agricultural societies.

OUTLOOK.

The extension work in Connecticut is well organized and administered. Statutory provisions for strong financial support gives assurance of stability and permanency to the county-agent system. The generally close coordination of the work of the extension specialist, farmers' institutes, and extension schools bespeaks harmonious relationships and teamwork. The one advisory specialist with headquarters at the college still sent out for general advisory work with individual farmers would seem to be an anomaly in the present well-organized system.

DELAWARE.

Division of Extension Service, Delaware College, *Newark.*

HARRY HAYWARD, *Director.*

History.—On February 21, 1889, the first farmers' institute was organized as the Farmers' Institute of New Castle County at a meeting held at Delaware College at Newark. On March 29 of the same year a law appropriating $600 was enacted, which provided for an institute in each of the three counties. At first the meetings consisted of single sessions, but later all-day meetings were held. In 1900 Kent and Sussex Counties joined in holding an institute for two days. Since that year 2-day institutes have been the rule. In 1903 the legislature authorized the State board of agriculture to appoint a State director of farmers' institutes to cooperate with the

several county organizations in securing speakers, arranging and advertising the meetings.

On April 6, 1911, a law was enacted creating an agricultural extension division at the Delaware College and appropriating $4,500 for each of the two years following to be used for extension teaching. In 1913 the appropriation was increased to $10,000 for the succeeding biennium. The governor of the State assented to the terms of the Smith-Lever Act on June 20, 1914, and on February 9, 1915, the legislature accepted the terms of the above-named law. At the same session of the legislature $3,628 was appropriated to meet the increasing Smith-Lever funds for the following two years. On April 1, 1915, the county agents for the three counties of the State were appointed.

Organization and administration.—The dean of the agricultural department and director of the experiment station is also director of the extension service and State county-agent leaders. The extension workers were principally faculty members of the agricultural college or the experiment station. Five persons gave full time, one person gave more than half time, and eight less than half time to extension work. The head of the home-economics teaching department was also the leader in the extension work of the department. A man was employed for half time as leader in poultry husbandry. A woman was engaged for the summer months to conduct boys' and girls' garden clubs. There are also three county agents, who report directly to the extension director. The heads of departments are responsible for the subject matter and methods of presentation. The State board of agriculture holds farmers' institutes, and the college cooperates by furnishing speakers whose expenses are paid by the State board of agriculture. The county agents also attend farmers' institutes and explain their work. The members of the extension force are quartered in the departments of the college.

Publications and mailing lists.—Small bulletins entitled "Food Values of Apples and Corn" and "Egg-laying Competitions, Their Aims and Accomplishments," were published by the extension division. The mailing list is composed of 3,000 unclassified names.

Finances.—During the fiscal year closing June 30, 1915, the following funds have been available for extension teaching:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers cooperative demonstration work	1,600
United States Department of Agriculture, Bureau of Animal Industry	260
State appropriation	5,000
Miscellaneous sources	1,130
Total	17,990

Smith-Lever funds were used for the county-agent work, administration, and in home economics, boys' and girls' clubs, and demonstrations in crops and fertilizers, orchard fertilization, and in poultry husbandry. The United States Department of Agriculture has cooperated by furnishing funds for support in part of the following projects: County agents, cow testing, and dairy farming. The requisition system of making purchases is used, and all vouchers are signed by the director. A record is made of proposed travel and the purposes of the trips.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—A county agent was employed cooperatively by the United States Department of Agriculture and the extension division of the college in each of the three counties of the State—Sussex, Kent, and New Castle. The counties are not supporting the work financially. The agent in New Castle County is endeavoring to establish a farmers' market in Wilmington. During the year the agents have taken in person, or assisted in taking, 166 farm management demonstration records, 63 of which have been returned to the farmers in person with such suggestions as might increase the profits of the farms. Plans for the construction of 14 silos have been furnished and 22 alfalfa demonstrations conducted. During the year the following clubs have been organized by the agents: A pig, a poultry, a corn, potato, girls' canning, and a boys' club, with a total membership of 130.

Spraying and pruning demonstrations were conducted in all of the counties by the horticultural specialists from the college of agriculture working in cooperation with the county agents.

Poultry husbandry.—The man, who is employed on half time to conduct this work, visited poultry raisers and gave them advice regarding housing and feeding; he also demonstrated how to select laying and nonlaying hens.

Crops and fertilizers.—These demonstrations have been conducted by the county agents in cooperation with the professor of agronomy and his assistant. Thirteen demonstrations in two counties have been made in top-dressing grass and wheat land. The result has been an increased yield of nearly 100 per cent.

Orchard fertilization.—Members of the horticultural department have conducted this work in cooperation with the agents of Kent and Sussex Counties. Twenty-five orchards from 1 to 18 years old were secured as demonstrations, in which nitrate of soda was used as a top-dressing.

Home economics.—The home-economics work was centered upon kitchen improvement. Four schoolrooms in different parts of the State were fitted up with useful and necessary kitchen equipment. Farm women were invited to visit these improvised model kitchens and their equipment. At these schoolhouse centers on alternate days of the week, for five weeks, the women were instructed in some phases of home economics. About 50 women were reached, most of whom made use of the suggestions. The Delaware Cooperative Educational Association, an organization which aims to bring together all the welfare agencies of the State, is cooperating with the college and is giving support to the work. The Delaware College for Women, recently organized at Newark, has taken an active interest in the home-economics extension work. The United States Bureau of Education is giving support to the Delaware Cooperative Educational Association in furnishing two women workers and providing leaflets for distribution in this work.

Boys' and girls' clubs.—Boys' and girls' clubs are conducted by the college on Smith-Lever and State funds in close sympathy with the United States Department of Agriculture. Besides the boys' and girls' clubs organized by the three county agents, garden clubs for boys and girls were organized in Newark and a teacher employed to supervise the work during the two summer months when she was not engaged in the public schools.

Members of the college and experiment station staff were called upon for service at farmers' institutes, miscellaneous meetings, and to advise individual farmers.

OTHER EXTENSION WORK.

Dairying.—A man is employed cooperatively by the Dairy Division of the United States Department of Agriculture and Delaware College to work in cooperation with the county agents in developing the dairy interests of the State by assisting individuals to figure balanced rations, encouraging the building of silos, advising as to pure-bred sires, and by giving assistance to persons operating creameries.

OUTLOOK.

The work done through the joint efforts of the county agents and the heads of the departments of agronomy and horticulture, together with the special dairy agent, have apparently been satisfactory, though a more systematic plan for follow-up work, and a careful recording of appreciable results would seem desirable. As increased funds for developing the work become available it would seem desirable to increase the administration assistance in the work.

IDAHO.

Division of Extension Work, College of Agriculture, University of Idaho, *Boise.*

O. D. Center, *Director.*

History.—Beginning in 1898, farmers' institutes were conducted by the agricultural college of the University of Idaho, and from 20 to 30 such institutes were held each year until 1900. During the meeting of the general assembly of 1900, $2,000 was appropriated with which to conduct this work. No county-institute organizations were formed. The great distance from the agricultural college to the agricultural sections of the State and lack of easy means of communication made it very difficult to conduct the work from the agricultural college. From 1900 to 1910, the State provided funds each biennium for the expenses of the members of the experiment-station staff who attended farmers' institutes. In 1910 a department of agricultural extension for southern Idaho was organized as a department of the agricultural college and experiment station with headquarters in the capitol at Boise. This location was selected in order to place extension teaching in agriculture more nearly within easy access of the farming population of the State. In the same year the State legislature appropriated $4,000 with which to conduct farmers' institutes and other agricultural-extension teaching for the succeeding biennium. In 1911 $24,000 was appropriated for the following two-year period. During this period an agricultural-extension teaching staff was organized to include instructors in animal husbandry and dairying, horticulture, home economics, field entomology, and a few county agents who were employed in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture. On August 19, 1912, the first county agent began work in Bonner County. By July 1, 1914, 10 persons had been employed for full-time extension service. The governor of the State gave his assent to the provisions of the Smith-Lever Act previous to May 21, 1914, and by an act of the general assembly passed by the house February 25, 1915, and by the senate March 2, 1915, the terms of the Smith-Lever Act were accepted.

Organization and administration.—The agricultural-extension department was organized on a State-wide basis in 1914. It retained the same location at Boise as the former department of agricultural extension for southern Idaho; at its head is a director of extension who reports to the president of the university at Moscow. The director of the experiment station is also assistant director of extension, and the director of extension is also assistant director of the experiment station. At the end of the fiscal year there were also a State county-agent leader, a State leader of boys' and girls' clubs,

two instructors in home economics, a field horticulturist and entomologist, a field assistant in animal husbandry, a pure-seed specialist, and three county agents.

Publications.—Publications were issued during the year dealing with county-agent work, live stock, and home economics, and also 35 press bulletins.

Finances.—The funds named below were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	4,800
United States Department of Agriculture, Bureau of Animal Industry	1,525
State appropriation	6,005
County appropriation	1,616
Miscellaneous organizations	500
Total	24,446

Smith-Lever funds were used in support of the work of the county agents, home economics, boys' and girls' clubs, and dairy extension projects. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, and dairy extension.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were two county agents and on June 30, 1915, there were three, working in the following counties, Canyon, Franklin, and Lewis. This work is conducted in cooperation with the United States Department of Agriculture and the State college of agriculture. Local appropriation for the support of the county agent is made by the county commissioners. In different parts of the county there were organized local-betterment clubs, whose presidents form the advisory council of the county farm bureau. The county commissioners designate one member of the board of county commissioners to be the special consultant of the county agent and to be a member of the farm-bureau council. An important line of work undertaken by the agents has been in connection with the control of hog cholera and other diseases of live stock. Among the minor features of their work has been the control of grasshoppers by using a spray of arsenite of soda in infested clover fields. It is estimated that clover seed valued at $30,000 was saved in one county by this treatment. Either at the county agents' suggestion or through their supervision 11 silos have been constructed, 75 cooperative buying and selling systems planned, 3 irrigation

systems were organized to supply water to 5,040 acres, 19 pure-bred male animals and 90 registered females were secured on the agents' recommendation or suggestion, 794 animals were treated for blackleg, 38 demonstrations given for the control of poultry diseases, and 2,200 hogs vaccinated to prevent cholera.

Home economics.—This project is in charge of a specialist, with two assistants. The home-economics specialists cooperate with the county agents in planning and advising on water supply for the kitchen and in the construction of cesspools and septic tanks. The girls' and women's clubs were assisted in their local meetings in bread making, butter making, sewing, canning, and preserving. In this work the home-economics instructors were cooperating with the supervisor in boys' and girls' clubs, the county superintendent of schools, and the county agents. During the year 207 meetings were held for the furtherance of this work, at which the attendance was 13,588.

Boys' and girls' clubs.—Boys' and girls' clubs are in charge of a State club leader, who for the three summer months was furnished five assistants. The work under this project is conducted in cooperation with the school authorities and teachers, who have organized 696 clubs with a total membership of 7,840. The mother-daughter group of 126 clubs has 1,000 members who completed all the work required of them. One hundred and twenty clubs received instruction in sewing and 97 in poultry raising. Four thousand eight hundred and five members completed the work, at a per capita expense of 99 cents for instruction. One garden club raised and canned over $8,400 worth of vegetables, which was nearly twice the entire expense of conducting the boys' and girls' club work in the State. It is estimated that the value of the club products was $22,350, half of which was to the credit of the 81 home-garden clubs. The State Bankers' Association contributed liberally to the financial support of boys' and girls' clubs.

Dairying.—A dairy specialist made demonstrations in the use of alfalfa, grain, and silage in various mixtures as a supplement to grain for dairy ration. He also supervised the building of a modern dairy barn near Buhl. Following the erection of this barn similar barns have been constructed. He has assisted in the building of 17 silos, the organizing of breeding circuits, and in forming of one cow-testing association and one cooperative creamery.

OTHER EXTENSION WORK.

Under the State law a special appropriation is made for securing pure seeds and much of this work is conducted by a person who is closely related to the agricultural-extension division, and who works

in close cooperation with the instructors of that department. Seed samples are sent into the extension department for determining their purity and viability. A general examination of all farm and garden seeds on sale by dealers has also been made by the special inspectors. Meetings are held at which farmers are given instruction in rogueing and in which the economic value of clean, pure seed, weed injuries, and plant diseases are discussed.

Specialists.—The animal-husbandry specialist assisted in the building of 11 silos and 5 barns and in selecting 41 pure-bred animals and 230 feeders. Sixty-nine antihog-cholera organizations have been formed through his efforts.

The horticultural specialist conducted an orchard-irrigation demonstration near Twin Falls. He has also conducted demonstrations in the hill selection of seed potatoes and in the control of diseases and insects which attack potatoes. A little work was done in farm-management demonstrations with State funds, but no report made upon it.

Extension schools.—Under this project both farmers' institutes and agricultural-extension schools were conducted. Communities desiring an agricultural-extension school formed a local organization and presented to the extension division a formal petition containing the names of not fewer than 50 persons who pledged themselves to attend and support the school. The most successful schools have resulted when the local organization was formed principally of farmers. The sessions continued through four days, during which time instruction was given by means of lectures and demonstrations. Twenty-three schools were held in 16 different counties, with a total attendance at all sessions of 90,756.

One hundred and eighty farmers' institutes were conducted, with an attendance of 13,000. Twenty-four of the instructors were members of the agricultural-extension staff. Twelve additional instructors were successful farmers.

OUTLOOK.

The extension work in Idaho is organized on a sound basis of coordination and cooperation within the institution and is being conducted aggressively with the forces and funds available to meet the needs of the different sections of the State. The plan of local extension work through county agents is regarded by the State as sound for Idaho, and this work is making a healthy growth. Effective use has been made of the various extension forces of this department in the extension work of the State, and the cooperative relations throughout have been most cordial.

ILLINOIS.

Division of Demonstration Work, College of Agriculture, University of Illinois, *Urbana.*

E. DAVENPORT, *Director;* W. F. HANDSCHIN, *Assistant Director.*

History.—The first farmers' institute in Illinois was held under the auspices of the Illinois Industrial University at Champaign, January 12 to 22, 1869. It was announced to continue through eleven days and to consist of practical lectures. In 1873 eight such institutes were held in the State, but these were the last held under the auspices of the university. In 1875 a board of institute directors arranged to continue the institutes without expense to the university, but the community served was expected to defray the local expense. Later the agricultural organizations of the State took upon themselves the financing, organizing, and furnishing of competent instructors for farmers' institutes. About 1880 the State board of agriculture took up the work where the university abandoned it seven years before and appropriated sufficient money to hold at least one institute in each congressional district in 1882. In 1889 the State appropriated $100 for each congressional district, to be used by the State board of agriculture for farmers' institutes. In 1891 the institutes of a county were placed in charge of a county organization which reported to and drew through the State auditor. In 1895 the Illinois Farmers' Institute was created as a State organization, but not until 1897 was money appropriated to conduct the institutes in cooperation with the county organization. In 1901 a small library for the use of farmers was put into circulation by the State farmers' institute. The Illinois Association of Domestic Science cooperated with the farmers' institutes by giving instruction in home making and home keeping. After working along separate lines for twenty-five years, the period from 1895 to 1905 found the college of agriculture of the university and the farmers' institutes working together to promote and develop a better agriculture. The first extension school in agriculture was conducted by the agricultural college in 1910. It was conducted for one week and primarily for young people rather than for adults. The first well-organized club in which formal instruction in agriculture was given to boys and girls was formed in 1910. The first county agent was employed by an association financed by farmers and business men of Dekalb County, June 1, 1912. The terms of the Smith–Lever Act were assented to by the governor on July 7, 1914, and they were accepted by a joint resolution of the State legislature, adopted by the house, March 3, 1915, and concurred in by the senate, March 4, 1915.

Organization and administration.—The agricultural-extension division was organized with the dean and director of the agricultural college and experiment station as its director, who has gen-

eral supervision. There is a vice director, who has charge of the administration of the work done by the specialists representing the agricultural and home-economics departments. He is also State leader in the county-agent work. The vice director has immediate charge of all work intended for adults, while a superintendent of agricultural extension has general direction of extension work for young people. The county-agent leader has an assistant, and the superintendent of agricultural extension also has an assistant in immediate charge of the boys' and girls' clubs. There is a group of specialists made up of teachers and investigators from the agricultural college and experiment station, giving part time to extension work. In this work the instructor is responsible to the subject-matter department which he represented. Theoretically, each of these specialists is administratively responsible to the vice director, but in practice is also responsible to his departmental head, because his movements and service are rendered largely to the county agents (advisors) who seek the assistance of specialists by correspondence with the head of a department most closely related to the service desired.

The county agents are chosen by a strong county organization, which is usually an incorporated body of men on a paid membership basis of from $10 to $15 each per year, and is usually known as a soil and crop improvement association. In some counties there was at the outset a restricted membership. Through the organization represented by the county agent most of the extension activities of the college of agriculture are conducted in those counties having agents.

Officers, extension specialists, and county agents rank with those having equal responsibilities in teaching or research positions at the college of agriculture and experiment station. There is no cooperative relationship between the agricultural-extension division and other State organizations, except the State farmers' institute, at which the specialists and other members of the extension division deliver lectures upon invitation.

Publications.—Two bulletins, one an announcement of extension service in household science, and another on boys' and girls' pig clubs, were published, both paid for from Smith-Lever funds.

Finances.—The following funds were available for extension work during the fiscal year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	16,726
United States Department of Agriculture, Bureau of Animal Industry	240
College of agriculture	3,539
State appropriations	14,600
County organization funds	50,000
Estimated	95,105

Smith-Lever funds were used for the following projects: Administration, county agents, home economics, and agricultural specialists. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, cow testing and dairy farming. All vouchers paid are countersigned by the director of agricultural extension. A detailed financial statement has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—This work was inaugurated in June, 1912, and cooperative relations with the United States Department of Agriculture were entered into September 1, 1914. At the beginning of this year there were 14 county agents; at the end of the year there were 18. As has already been referred to, most of the soil and crop improvement associations had a limited membership, in some instances not over 300. Upon the farms owned by these members, demonstrations in field crops, soil fertility, animal breeding, and farm equipment and conveniences were conducted by the county agent. These demonstrations are made the particular point of interest at public meetings occasionally called for the benefit of those who live near by. The farms representing the membership, therefore, become the points at which an established fact or practice is demonstrated and from which the near-by farmers may be benefited. The county agents in Illinois had the advantage of beginning their work with a definite program of soil and crop improvement furnished by the State college of agriculture, namely, lime, rock phosphate, and clover.

The work of the agents included the following demonstrations: Hog-cholera control with 16,156 hogs; feeding demonstrations on 769 farms; use of rock phosphate to reinforce manure on 188 farms; began raising alfalfa on 2,932 farms; used lime on 22,600 farms; practiced green manuring on 2,642 farms; oat-smut control on 2,217 farms.

Demonstrations in home economics.—This work has been conducted in cooperation with high schools, principally along the lines of food preparation and for the purpose of arousing a local interest in providing means and equipment for conducting home-economics work regularly in the public schools. This project has also been worked out in 31 extension schools of one and two weeks' duration with a total attendance of 3,312; in 18 of these two instructors gave the instruction and demonstrations and in 13 one instructor presented the work. The State leader of home economics has cooperated with the farmers' institutes by giving addresses and demonstrations so far as conditions permitted. An object lesson in house furnishings, conveniences, etc., was prepared in a demonstration car at an expense of about $3,500. This car is used in connection with the week short

courses or extension schools and is accompanied by at least two lecturers, a man and a woman.

Departmental advisors in agriculture.—The extension instructor in agronomy of the college of agriculture interested the farmers in southern Illinois in the buying and applying of crushed limestone during the year; the use of this material increased from 3,000 to 27,000 tons this year. In animal husbandry the chief accomplishment was the delivering of lectures at farmers' institutes, and short courses, and in conducting exhibits at fairs and expositions.

OTHER EXTENSION WORK.

Dairying.—The dairy department, which had under its jurisdiction six cow-testing associations, found its work greatly interfered with because of foot-and-mouth quarantine. However, three associations were still in existence, representing 65 herds with a total of 1,311 cows. The division of horticulture conducted 10 spraying and pruning demonstrations in farm orchards, most of which were given under the auspices of the county agents in Adams, Will, and McHenry Counties.

Boys' and girls' clubs.—Ten clubs were organized with a total membership of 1,158. These included corn clubs, garden and canning clubs, and pork and crop production clubs. Seventy-one members completed the work required.

Club work in Illinois is carried on in cooperation with the United States Department of Agriculture.

OUTLOOK.

The county-agent system is well under way in the northern and central part of the State, and definite plans are being made for its further extension into the southern part. It is fortunate that the research work of the college in past years has been of such a nature throughout the State as to put into the hands of the county agents at the outset definite plans for soil improvement and increased crop yields. The plan of organization in practically all counties having agents has been so modified as to provide for unlimited membership in the county associations and reach all parts of the county. The extension division at the college is gradually being consolidated and coordinated, and the prospects for effective extension work along practically all lines is most satisfactory.

INDIANA.

Division of Agricultural Extension, Purdue University, *La Fayette.*

G. I. CHRISTIE, *Director.*

History.—In 1882 the initial step was taken to secure popular instruction for farmers. Two institutes were held under the auspices of the State board of agriculture before the close of March of that

year. During the following seven years a few institutes of from one to three days were held each year. In consequence of this work the general assembly appropriated $5,000 on March 9, 1889, and in the fall of the same year the farmers' institute work was organized under State control. The number of institutes held each year increased, and by 1893–94 a one-day institute was held in each of the 92 counties of the State. At first they were held at the county seats, but during later years holding them in other parts of the county proved more successful. In 1901, $10,000 was appropriated to conduct institutes. Under the provisions of the institute act the board of trustees of Purdue University appointed a joint committee consisting of the president of the university, the director of the experiment station, and the professor of agriculture to take charge of the institutes. The last-named person had direct supervision and was called superintendent of institutes. Experience demonstrated the necessity for local organizations to develop an interest in the communities, consequently local institutes were organized with proper officers. From 1893–94 to 1903–4 from 95 to 175 farmers' institutes were held each year in the 92 counties of the State. A woman's auxiliary to the institute had been organized in many counties, which was conducted independently of the institute, but the time of meeting was often the same as the annual farmers' institute. Members of the agricultural faculty and several of the general faculty rendered service without charge to the institutes. The local expenses of the meetings were met by an appropriation of $25, which was apportioned to each county. At present the farmers' institutes constitute one of the departments of the extension division.

In 1909 an appropriation of $10,000 was made to the experiment station to conduct the work of a newly organized extension department. In 1911 an appropriation of $10,000 for the first year was made directly to a newly organized agricultural-extension division, which was made coordinate with the experiment station and college. Thirty thousand dollars was voted for the succeeding year, but on account of litigation this amount was not available until 1914. Ten thousand dollars which had been voted to the experiment station for extension teaching was also added to the $30,000 already appropriated, which made a total of $40,000 with which to conduct extension work in 1914–15.

On September 1, 1912, boys' and girls' club work was organized in cooperation with the United States Department of Agriculture. On this date a State agent of boys' and girls' clubs was appointed in cooperation with the Bureau of Plant Industry, United States Department of Agriculture. On October 1 of the same year the first county agent began work in Laporte County. This work also was conducted under a cooperative arrangement between the United

States Department of Agriculture and the extension department of Purdue University. In 1913 the State vocational education law was enacted, and by its terms county agents and the State leader of boys' and girls' clubs became a part of the public-school organization of the State. The extension work is to be supervised by the extension division of Purdue University.

The governor assented to the terms of the Smith-Lever law on June 25, 1914, and on March 8, 1915, the general assembly accepted its terms.

Organization and administration.—On July 2, 1914, when the memorandum of understanding became effective between the United States Department of Agriculture and Purdue University, three educational-extension agencies were found to exist in the State. These agencies were Purdue University, the United States Department of Agriculture, and the State department of public instruction, which, by the vocational education law, was coordinate with the university in its relation to county-agent and boys' and girls' club work. At the university there are three divisions of equal rank—the college of agriculture, the experiment station, and the extension division.

There are five major divisions of the extension division: Short courses, boys' and girls' clubs, county-agent work, farmers' institutes, and specialists. The latter section includes specialists in animal husbandry, botany, dairy husbandry, entomology, home economics, horticulture, poultry husbandry, soils and crops, and veterinary medicines.

The relationships of the extension division and the State department of public instruction are somewhat complicated by the vocational education law.

The extension director is assisted by: (1) An assistant director, in charge of short courses. (2) A State leader of boys' and girls' clubs, who is appointed by the State department of public instruction. The State club leader has an assistant club leader appointed by the extension director. (3) An assistant county-agent leader. (4) A State leader of institutes.

In 1914–15 there were 29 persons giving full time to extension service. In addition to these, there were 23 persons giving part time, most of whom are members of subject-matter departments of the college. The specialists from the college of agriculture whose services are needed in the field report directly to the heads of their departments. The subject-matter departments also perform some administrative functions. All correspondence concerning the field work of the specialists passes through the heads of the college departments. However, there is a close relationship existing between the administrative agent of the extension division and the subject-matter departments.

Publications and mailing list.—There were 29 publications issued during the year, none of which were paid for from Smith-Lever funds. There is no extension mailing list. When a bulletin is issued notice is given in the agricultural press, and those desiring copies write to the extension division for them.

Finances.—The following funds were available for extension work for the year closing June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	13,065
United States Department of Agriculture, Bureau of Animal Industry	1,614
State appropriations	64,145
County appropriations	44,935
Other organizations	3,067
Miscellaneous sources	1,430
Total	138,256

The accounts are kept by the extension division, where duplicate vouchers are on file. At the close of the year these duplicates are sent to the State treasurer. Original vouchers are on file in the office of the treasurer of the university. Vouchers are taken for every item of field expense. The following projects were partially supported by Smith-Lever funds: Administration, county agents, horticultural demonstrations, home economics, poultry demonstrations, extension schools, and agricultural specialists. A detailed financial report has been received and approved. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, pig clubs, and cow testing and dairy farming.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 27 county agents and on June 30, 1915, the first year under the vocational education law, there were 31. The county-agent work is under the direct supervision of an assistant State county-agent leader. When 20 or more residents of a county actually interested in agriculture file a petition with the county board of education, requesting a county agricultural agent, and accompany the request with a deposit of $500, the board shall file a petition with the county council, which body shall appropriate annually $1,500 toward the salary and expenses of the county agent. When the county appropriation is made, the county board of education applies to the university for the appointment of a county agent, whose appointment is made annually subject to the approval of the county board of education and the State board of

education. After the appointment is made the State appropriates one-half of the salary of the county agent, provided not more than $1,000 be appropriated to any one county. In most counties the agent has his office with the county superintendent of schools. In addition to making personal visits to farms and attending to personal calls and correspondence at the office, the county agents have been engaged in conducting campaigns as follows:

Campaigns conducted.

Name of campaign.	Counties.	Number of meetings.	Name of campaign.	Counties.	Number of meetings.
Silos	8	60	Orchard management	21	57
Seed-corn selection	25	280	Alfalfa	31	143
Wheat	27	190	Live stock	1	12
Hog production	9	18	Soil improvement	1	6
Oat smut and potato scab	12	74	Wild-onion control	6	6
Horse improvement	26	114			

A summary of all the reports shows that 4,515 meetings were held with an attendance of 342,971. During the year 31,262 people called at the offices of the county agents for advice and suggestions. The county agents have also conducted demonstrations as shown in the following table:

Demonstrations conducted.

Name of demonstration.	Number of counties.	Number of farms.	Name of demonstration.	Number of counties.	Number of farms.
Seed-corn selection	20	494	Fertilizer	18	94
Orchard management	22	269	Five-acre corn plots	12	238
Oat-smut control	18	172	Alfalfa growing	19	418
Green manuring	13	47	Hog-cholera control	17	39
Liming	23	241	Live-stock feeding	13	38

In the corn-growing demonstrations, 21 of the farmers grew over 100 bushels of corn per acre, which yield was far above the average farm corn crop. The average on 238 farms, from which reports were received where the corn-growing demonstrations were conducted, was 72.4 bushels per acre, or twice the State average. The extension division states that the cost of raising an acre of corn in Indiana is $13.49, which at the average yield of 36.4 bushels places the cost of producing a bushel of corn at 37.1 cents. One of the highest yields was secured on a demonstration farm at a cost of 17.1 cents per bushel. The average cost of the 238 five-acre plats was $13.52 per acre, or 18.6 cents per bushel. More than 600 farmers entered upon this work in the spring of 1915.

One hundred and seventy-two field demonstrations were made on oat-smut control. Only forty-nine one-hundredths of 1 per cent

showed smut in the fields where treated seed was sown. Twelve and four-tenths per cent showed smut where no treatment had been made. The results from the fields in which treated seed had been sown was an increase of from 5 to 10 bushels per acre. The cost of treatment is estimated at 4 cents per acre. Druggists reported that more than 5,500 pints of formaldehyde were sold in the spring of 1915. The reports from 10 counties in which the alfalfa campaigns were conducted in both 1914 and 1915 showed an increase from 265.7 acres in 1914 to 901.3 acres in 1915, an increase of 239 per cent. Meetings to interest farmers in the building of silos were held on farms having silos. The experiences of the farmer owning the silo were brought out, and an opportunity was furnished for the study of the silo itself.

Home economics.—Twenty-five one-day demonstration meetings, with an attendance of 4,422 women, have been held at churches and other public meeting places. The character of the work in these one-day meetings has depended upon the wishes of the women desiring the service. At one time it has been a study of foods, at other times laundering, home sanitation, feeding of children, care of sick, household conveniences, etc. In many cases the demonstrator went into the homes on request. During the year 365 homes have been visited in 23 counties. Another line of work conducted under this project was the two-day meetings held simultaneously with the agricultural short courses. As a result of either the independent meetings or the sessions for two days with the short course, about 80 women's clubs have been formed, which hold monthly meetings for the purpose of studying the home-economics methods as suggested and outlined by the home-economics extension force of the university. These outlines are planned to cover a period of five years. A questionnaire has been submitted to a large number of women with a view to securing information as to their problems, to assist the institution in shaping its home economics extension work more definitely.

Agricultural specialists.—Most of the work done under this project was conducted by specialists in soils and crops, horticulture, animal husbandry, dairying, poultry husbandry, and veterinary medicine, who were cooperating with the county agents in the educational campaigns already named. Each county agent who found particular need for the services of a specialist sought the assistance of the subject-matter department which he considered would most effectively serve his purpose.

Horticultural demonstrations.—When an orchard demonstration was desired, 25 persons sent a formal request to the director of agricultural extension, who set a date and made the arrangements for conducting the work, the demonstrations being made by the head of

the horticultural department and his assistants. The meetings were conducted for one day on the farm where the orchard was located. In the forenoon a lecture was given on orchard management, followed by a pruning demonstration. In the afternoon a lecture was given on insects and fungus diseases, followed by a spraying demonstration. Eighty demonstrations, with an attendance of 6,589, were held in the spring of 1915. Additional work was done on small fruits, landscape gardening, and yard improvement. A few demonstration orchards have been located which are cared for in whole or in part by the horticultural department. Arrangements are being made whereby these demonstration orchards can be supervised by the county agents.

Farm poultry management.—Through the cooperation of the county agents, nine poultry demonstrations were located in seven counties. The object in this work is to emphasize the importance of keeping records, using modern equipment, and to prepare poultry products for the market. Meetings are held from time to time on these farms that people may see the results. The leader of this project believes that as a result of these meetings the average price of eggs in some communities has been increased about 3 cents per dozen.

Extension schools.—Short courses as conducted in this State consist of three days of instruction, by means of lectures and demonstrations, on live stock, crops, soils, horticulture, dairying, poultry, and home economics. A staff of seven instructors goes from the university with a carload of live stock and other equipment necessary. The live stock consists of a good and a bad type of fat cattle, dairy cows, horses, sheep, hogs, and poultry. The use of university live stock permits the animal-husbandry instructor to be perfectly free in making unfavorable comment or in pointing out any particular weakness in an animal. The same animals are also used for judging by members of the school. The extra equipment consists of a model poultry house, milk testers, samples of seeds, feeds, etc. The short course is usually held in the high-school building, where there is ample room to conduct the work on the departmental plan. On the first day of the school each member of the school chooses the particular line of work which he expects to take. A home-economics school is conducted for women during the same period. During the past year the foot-and-mouth disease interfered with the plans and schedule for the short-course season; however, the courses were conducted without the animal-husbandry feature and in much smaller villages than the work had ever been conducted in before. Twenty such schools were held, with a total attendance of 5,595.

OTHER EXTENSION WORK.

Boys' and girls' clubs.—The boys' and girls' club work is related very closely to the public-school system of the State. It has already been stated that the leader of boys' and girls' clubs is appointed by the State department of public instruction, but the assistant State leader, who is appointed by the extension department, cooperates with the State leader in forming organizations of boys and girls and in conducting the work through local leaders. These are usually teachers employed for the summer months for follow-up work. The county superintendent of schools is recognized as the county leader. He assists in instructing the teachers and in promoting the work locally. Twenty-one rural teachers were employed jointly by the local school authorities and the extension department of Purdue University, to remain during the summer vacation in the communities where they taught. They were able to visit each pupil engaged in club projects about every 10 days. They reported weekly results of their work to the local school authorities and to the State leader of boys' and girls' clubs. The county agents assisted in organizing 112 clubs with a membership of 3,697. One hundred and ninety-two boys out of 341 and 63 girls out of 116, who were in counties having agents, were awarded scholarships to the State Corn School, held during the farmers' short courses at Purdue.

Farmers' institutes.—One or more institutes are held in each county during one, two, or three days. Some instructors are provided by the extension division, the expenses of the institute being provided for by a county tax and an admission fee of 25 cents. The other instructors are usually successful farmers, who discuss soil improvement, farm crops, live stock, agricultural cooperation, rural social betterment, good roads, and the country school. Four hundred and fifty institutes, with an attendance of 274,187, were conducted last year by a force of 50 lecturers, 17 of whom were members of the extension staff and 33 from other sources. The total amount of money spent for farmers' institutes was $16,811.31.

Farm-management demonstrations.—During the year 313 farm-analysis records have been taken in five counties—Benton, Bartholomew, Madison, Pulaski, and Washington. The analyses for all of them have been made and 247 have been returned in person to the farmers. One hundred and fifty-seven farmers are planning changes as a result of the analysis and recommendations of the demonstrator. Meetings are usually held in homes and schoolhouses.

OUTLOOK.

On June 30, 1915, one-third of the counties of the State had agents. To these men it is largely due that the variety and number of demonstrations were held as stated in this report. Cooperation between the extension division of Purdue University, the State

department of education, and the United States Department of Agriculture with the county agent is close and effective. The State law provides for the gradual increase of county agents for the entire State.

Since the boys' and girls' club work is by State law so closely related to the schools, greater results may follow in this feature of the work than statistics alone would indicate.

Generally speaking, effective extension work is being done throughout the State. A good spirit prevails among the extension forces. The work of the specialists is made especially effective because of the large number of counties organized with county agents with whom they can cooperate in demonstration work suited to the needs of each farming community.

IOWA.

Division of Extension, Iowa State College, *Ames.*

R. K. Bliss, *Director.*

History.—During the winter of 1870–71 a number of farmers' institutes were held, the expenses of which were borne by local contributions. The same plan of defraying expenses was continued for many years. In 1890–91 the State Agricultural Society appropriated money to pay the institute expenses of college professors. A law was enacted in 1891 appropriating $50 to each county with which to hold farmers' institutes, which was so amended in 1902 that $75 was available for each county. There has been no central or State organization responsible for conducting institutes, and each county has acted independently of others in organizing its farmers' institutes. During the winter of 1903–4, 70 out of 99 counties held institutes. On July 1, 1906, the State legislature appropriated $15,000 with which to organize and conduct an extension department at the college of agriculture. These appropriations were increased from year to year until, on July 1, 1914, $85,000 of State funds were available. On August 16, 1912, boys' and girls' club work was organized by the extension department of the college of agriculture in cooperation with the United States Department of Agriculture, and on October 1 of the same year the first county agents began work in Clinton and Scott Counties under a cooperative plan between the college and the United States Department of Agriculture. The State legislature authorized counties to appropriate funds by vote of the people to assist in financing county-agent work. Only one county has so far availed itself of the provision of this law. The governor assented to the terms of the Smith-Lever Act previous to June 23, 1914, and on April 16, 1915, the legislature accepted the terms of the Smith-

Lever Act, and by the terms of the State law the treasurer of the college of agriculture was made custodian of any funds apportioned to the State for agricultural-extension purposes.

Organization and administration.—The agricultural-extension division was organized with the dean of the college as director of agricultural extension. In the plan of organization the extension division has an equal rank with the academic division of the college of agriculture and with the experiment station; in practice, it is considered one of the divisions of the college. The director of extension reports to the president of the college. During the past year the extension director has been State county-agent leader. In the county-agent work he has been assisted by an assistant State leader, who is directly in charge of the county agents. The director is enabled to carry out the field work through specialists who have charge of the instruction in home economics, farm crops and soils, veterinary medicine, pomology, truck gardening, and boys' and girls' club work. Each of the specialists reports to the director of extension. The specialist who has charge of boys' and girls' club work is also styled State leader of boys' and girls' clubs. He is assisted by a woman who has charge of the work for girls. The county-agent work is conducted in cooperation with the United States Department of Agriculture. When a sufficient number of persons desire a county agent, and so express themselves by petition to the county commissioners, an election must be called to vote on the proposition to appropriate funds to finance the undertaking. If the vote is in favor of employing an agent the commissioners must appropriate from county funds for part of this support. In the event the people do not desire to place the matter before the voters of a county, they may make voluntary subscription to the support of the agent. In most of the 11 counties having agents this latter plan is followed. Thirty-six persons give full time to extension work, and 36 give less than one-half time.

Publications.—Seventy-nine publications have been issued during the year. These were prepared principally by persons who were members of the extension division; the printing was paid for from State funds. Three bulletins, Unlawful and Other Weeds in Iowa, Yard and Garden Contests, and Lists of Farm Building Plans, have been distributed under Smith-Lever provisions.

Correspondence courses in agriculture and home economics are published with State funds, principally for public-school teachers who must qualify for teaching these subjects. A series of 10 lessons in agriculture for persons not teachers have been published in issues of 5,000 each. A series of 34 lessons in home economics have been prepared for housewives in issues of from 2,000 to 9,000 each.

Finances.—The following funds have been available for agricultural extension for the year closing June 30, 1915:

Smith-Lever funds	$10,000
United States Department of Agriculture, farmers' cooperative extension work	17,216
United States Department of Agriculture, Bureau of Animal Industy	8,682
State appropriation	88,704
County appropriation	[1] 4,000
Local appropriation	[1] 46,150
Organizations	[1] 20,000
Total	194,752

Smith-Lever funds were used in conducting work under the following projects: Administration, county agents, home economics, itinerant demonstrations, oat-smut control, and specialists.

The extension director has a secretary who acts as the department accounting officer. Duplicate vouchers are obtained, and one is filed in the extension office and one is forwarded to the office of the treasurer of the college. The college makes an annual financial statement to the State treasurer. All service rendered by members of the college or station staff is paid for from extension funds, provided the service is properly authorized. Twelve instructors are paid in whole or in part from Smith-Lever funds.

The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, creamery extension, and dairy community development.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 9 county agents; on June 30, 1915, there were 11, all of whom were working under a cooperative plan between the United States Department of Agriculture and the extension division. During the year these agents have held 1,055 meetings and have visited 5,436 farms. Practically all of the demonstration work done by specialists is arranged for by the county agents. An important work done by these men has been the control of hog cholera. In counties having agents hog cholera has been so completely eradicated that the farmers and the county agents have made an extra effort to prevent the introduction of the disease from counties not having agents and have formed organizations to combat it.

Oat-smut control.—Much work has been done to control oat smut. About 60 demonstrations, in which specialists from the agricul-

[1] Estimated.

tural college assisted, have been made in each county to show how seed oats should be treated. At the oat-smut-control meetings some time is also given to the treatment of seed potatoes to prevent scab and, as a means to bring about some form of follow-up work, the names of persons who have promised to treat either their oats or potatoes are taken. During the past year 542 persons treated their seed oats and 526 reported favorably as to the results. Of 267 who treated their potatoes to prevent scab, 233 reported favorably.
the winning of the State championship in tomato growing by a girl, who received a cash return of $115.57 from one-tenth acre. The State championship for corn growing was won by a boy, whose acre yielded 139 bushels, nearly four times the State average.

Agricultural specialists.—In order to develop the work planned in this project, specialists are employed in home economics, farm crops and soils, pomology and truck gardening, and veterinary medicine. The extension work by specialists was conducted principally at the call of the county agents and others representing local organizations in counties not having agents. One hundred and sixty-four demonstrations were made in pruning, spraying, and controlling plant disease. In each spraying demonstration check trees are left unsprayed. A second meeting is held in the fall in the same orchard. Demonstrations were made in the control of tuberculosis and hog cholera. Poultry demonstrations are held at the same time the orchard demonstrations are conducted. The poultry instructor goes to the poultry house with those who are interested, where he discusses poultry management and where he sprays for control of lice and mites. Housing, light, and ventilation are emphasized. At other times demonstrations and discussions are given on judging, caponizing, feeding, and preparing poultry products for market. While many of the extension activities were carried on through the county agents, the work of the specialists has been more general and is represented over the State principally in meetings and accompanying demonstrations, as follows: One hundred and sixty-four meetings were held in connection with spraying and pruning, and 168 demonstrations were given in these subjects. In connection with hog-cholera control 286 meetings were held and 151 demonstrations were given. At 97 county, State, and district fairs meetings were held and 195 demonstrations given. One hundred and sixty-one demonstrations were given by specialists at 558 farmers' institutes and farmers' meetings. One hundred and sixty and one-half acres in 17 counties were used for corn-growing demonstration plats; 30 acres in 4 counties were used as oat-growing demonstration plats; 8½ acres in 3 counties and 8 acres in 3 additional counties were used for alfalfa-growing demonstration plats and other crop-growing demon-

stration plats, respectively. Assistance has been given to several cow-testing associations.

Itinerant demonstrations.—This work is conducted by selecting about seven good farms in a county to show different features of farm practice, equipment, and household conveniences. One feature may be a successfully grown field of alfalfa, another a good herd of dairy cattle, another a farm house having modern equipment. The persons making up the visiting party are conveyed in automobiles and other vehicles at their own expense. Short stops are made at each of the seven farms. The owner is expected to explain exactly how he proceeded to secure the results in whatever piece of work is being observed. While the men are in the field or at the barn, the women are being conducted through the house, where the plan, operation, and cost of making the improvements are explained by the housewife. One hundred and eighty such tours were conducted during the year.

OTHER EXTENSION WORK.

Farmers' agricultural short courses of from three to five days have been conducted during the winter season at 133 places in 33 different counties, with a total attendance of 12,698. Home-economics short courses have been conducted in 65 different places with an attendance of 5,874. The short course is usually given for a full week in a place, during which time the following subjects are discussed and such demonstrations given as are necessary: Animal husbandry, farm crops, horticulture, agricultural engineering, and, in some places, home economics. The equipment consists of one car of live stock, one car of demonstration material on agricultural engineering and farm crops, and one car of exhibits. The special lines of work are taken up in different departments, and the members of the school must choose at the beginning of the week the particular line of work in which they desire to receive instruction. The live stock is judged by the members of the school, but no other form of work is participated in by them.

There are many organizations that are directly or indirectly interested in the development of agriculture and the improvement of the rural home. The State board of agriculture, the dairy associations, the beef-producers' association, the beekeepers' association, the corn-growers' association, the dairy and food department, the State board of health, the child-welfare league, the State federation of women, the bankers' association, commercial clubs, and granges have assisted the extension division by promoting its interests throughout the State and by furnishing money and speakers for farmers' institutes and other meetings at which farm and home economics are discussed.

Club work.—The boys' and girls' club work has been conducted in cooperation with the United States Department of Agriculture and the extension department; however, the public-school system has contributed much to its success in that the teachers and other school officials took much interest in carrying out the follow-up work. As a result of this work the following members have been enrolled in clubs: Four thousand and fifty-three have enrolled in the acre corn clubs, 455 in garden and canning clubs, 625 in poultry clubs, 2,172 in garden clubs, 1,028 in cooking clubs, 1,538 in sewing clubs, 511 in manual-training clubs, 1,822 in canning and marketing clubs, 987 in baby-pork clubs, and 587 other minor club organizations, with a total enrollment of 13,678. One of the notable results of the club work was the winning of the State championship in tomato growing by a girl, who received a cash return of $115.57 from one-tenth acre. The State championship for corn growing was won by a boy, whose acre yielded 139 bushels, nearly four times the State average.

Farm-management demonstrations.—The work was conducted in cooperation with the United States Department of Agriculture, and no Smith-Lever funds were used in developing this project. From September 1, 1914, to June 30, 1915, 326 farm analyses records were made in 5 counties. One hundred and thirty-nine of the records have been completed and returned in person; 66 have been returned by letter; 95 farmers have adopted some plan of keeping farm accounts.

OUTLOOK.

Notwithstanding unfavorable State laws, the county-agent system of extension work has been made a substantial growth during the year, largely through the efforts of the extension force cooperating with public-spirited citizens and organizations. The boys' and girls' club work has made a good year's record in considerable measure, due to the management of effective follow-up methods. A strong feature of the year's work has been the extension schools which have been organized with recognition of the needs of both men and women. Cooperative relations at the college and throughout the State are cordial and the extension work well organized and administered.

KANSAS.

Division of College Extension, Kansas State Agricultural College, *Manhattan.*

J. H. Miller, *Director.*
[E. C. Johnson, appointed Director Oct. 1, 1915.]

History.—Farmers' institutes were first conducted in this State in 1868 under the auspices of the State agricultural college and the Union Agricultural Society. In June, 1869, a three-day institute

was conducted at the agricultural college at Manhattan, and institutes were held annually at the college until 1874. In 1881 the present system of farmers' institutes was begun, and during that year professors at the agricultural college took part in these institutes. The college then offered the services of three or more speakers to the 12 counties first seeking their services, provided the institute organizations selected at least half the speakers from those interested in agriculture in the immediate locality. Up to 1890 the expenses of the farmers' institutes were met by appropriations made by the board of regents of the agricultural college. In 1899 the State legislature made an appropriation of $2,000 with which to conduct institutes for each of the next two fiscal years, which plan of making appropriations was followed by succeeding legislatures. The number of institutes had increased from 6 in 1881–82 to 156 in 1900–1901.

The extension division had its beginning in 1905, when a superintendent of institutes was employed. The division grew rapidly, and in 1912 a division of college extension was created, coordinate with the experiment station, with departments of farmers' institutes and demonstrations, highway engineering, drainage and irrigation, home economics, and correspondence study. In May, 1914, the department of rural service was added. In 1905 the legislature appropriated $4,000 for conducting the farmers' institutes, to which amount the college of agriculture added $800. In 1907 the legislature appropriated $10,500 for the succeeding biennium for extension work, to which the college added $1,000. Succeeding legislatures appropriated money generously for the support of the extension service.

The first county agent was appointed February 1, 1913, to work in Leavenworth County under a cooperative agreement between the United States Department of Agriculture and the extension division of the State agricultural college. The governor gave his assent to the provisions of the Smith-Lever Act on June 2, 1914, and on May 1, 1915, the legislature accepted the terms of this act.

Organization and administration.—The agricultural-extension division is organized with a dean of college extension at its head. For the fiscal year of 1914–15 the division consisted of five distinct departments as follows: Institutes and demonstrations, rural engineering, home economics, home-study service, and rural service. In the department of institutes and demonstrations the director of extension is assisted by a county-agent leader, a superintendent of institutes, an assistant superintendent who has charge of extension schools, a State leader of boys' and girls' club work, a farm-management demonstrator, 6 agricultural specialists, 4 district agricultural agents, and 10 county agents. The head of the rural-engineering department is State engineer, the home-economics department has at its head a State leader of home economics, a director of correspond-

ence study is in charge of the home-study service, and a director of rural service has charge of the department of rural service. The total number of persons giving full time to extension work was 40, most of whom have offices with the subject-matter departments of the college. They are administratively responsible to the dean of the extension division and to the subject-matter departments for the matter and method of presentation. Field assignments are made by the extension director, to whom reports of the work done are made. Projects originate with the director of extension and with his department leaders and are submitted and approved with modifications by the subject-matter departments. The execution of the project is intrusted to the extension instructor assigned to it. Ten members of the extension staff have taken part in the farmers' institutes. In the western part of the State where the population is sparse there are 3 district agents, one of whom has charge of 11 counties, another of 8, and a third of 6 counties.

Publications.—Eleven publications were issued. There is no extension division mailing list. There are 14,000 names on the experiment station list which is used by the extension division. Bulletins are rarely sent to the entire mailing list.

Finances.—The following funds were available for cooperative extension work for the fiscal year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	14,046
College of agriculture	50,700
Local communities	1,736
Organizations	13,412
Miscellaneous sources	2,733
Total	92,627

Three projects—county agents, home economics, and specialists in agriculture, were supported in part with Smith-Lever funds. No Smith-Lever funds were used for printing or distribution of publications.

The Smith-Lever funds were deposited with the State treasurer and paid out on warrants issued by the agricultural college. All vouchers are made out in quadruplicate, one copy remaining with the extension division, one with the accounting division of the college, and two copies are sent to the State treasurer. Original vouchers are filed with the State treasurer; subvouchers are taken for all expenses over 25 cents. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm management.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 9 county agents and 4 district agents, covering an average of 8 counties each, and on June 30, 1915, there were 10 county agents and 4 district agents. During the fiscal year of 1914–15 the county-agent work was financed by Smith-Lever, the United States Department of Agriculture, and the college of agriculture funds, and by contributions from individuals and organizations. The county organizations usually consisted of from 75 to 200 members. A summary of the most important features of the work done by county agents follows:

Farm buildings planned or improved, 58; silos constructed, 36; water systems improved, 22; sanitary conditions improved, 91; farmers selecting seed corn in fall, 552; acres planted with selected seed, 4,705; farmers treating seed oats to prevent smut, 28; acres sown with seed so treated, 375; farms on which alfalfa was sown according to the agent's directions, 103; acres planted to alfalfa, 1,283; orchards cared for in whole or in part by county agents, 240; registered male animals secured on suggestion of the county agent, 145; registered female animals secured on his suggestion, 172; cows tested by individuals on suggestion of agent, 217; animals treated for blackleg on his suggestion, 2,014; hogs vaccinated by agents for prevention of cholera, 4,927; hogs vaccinated on the agents' suggestion, 14,322; antihog-cholera clubs formed, 4; advice on poultry-disease control, 65; reinforcing manure with acid phosphates or floats, 10.

Campaigns for the prevention of the Hessian fly have been conducted in every county having an agent. In Leavenworth and Harvey Counties practically all of the seeding was done after what is known as the "fly-free date." In western Kansas numerous demonstrations were made in the use of Sudan grass as a forage crop and in the use of orange sorghum as a silage crop. A record as to the location of good pure-bred sires is kept in the office of the farm bureau. When a sire has completed his period of usefulness in one county he may be transferred to another. During the current year, 1915, 20 sires were placed or transferred through the activities of the county agents. Demonstrations in renovating and managing commercial and home orchards have been conducted in practically all counties where agents are employed. Certain farms are selected in representative areas, on which an orchard is pruned and sprayed by the specialists in horticulture from the division of extension. As a result of a special effort by the county agents 506 farmers have sown sweet clover during 1915.

Home economics.—During the year 48 five-day extension schools for women were conducted, at which the attendance was 1,487, or an

average of 31 women at each school. In one type of the home economics extension school the members did individual work each day under the guidance of the extension instructor. In a second type a group of members demonstrated for the benefit of the entire school; in a third, the instructor demonstrated for the benefit of the members of the school. There were 26 schools of the first type, 2 of the second, and 20 of the third. A half-day session is given to the selection, preparation, and use of foods and half a day to the selection, use, and construction of clothing. These schools are held in church basements, schoolrooms, vacant storerooms, and in large kitchens in residences. Most of the utensils are borrowed or rented for the week. A membership fee of $1 is charged, with which to defray local expenses. Two classes of clubs often have been formed as a result of these schools, one for women and one for girls. Printed instructions in cooking and sewing are furnished these clubs by the college. Fourteen extension schools of one week each were held at the county normal institutes for public-school teachers. Practically the same program was rendered in these normal institutes as was given in the extension schools for adult women.

The home-economics specialists give instruction also in what are known as women's auxiliaries, associations of the wives and daughters of the men belonging to the farmers' institutes. There are 92 auxiliaries in the State with a membership of nearly 2,000. Many of these meet once a month, and programs and instructions are furnished by the home-economics department of the extension division.

Specialists.—By these men work in soils and crops, horticulture and entomology, poultry husbandry, irrigation, and drainage was conducted.

The specialists having in charge the instruction in soils and crops conducted their work during four months following the farmers' institute season. During the institutes agreements were made with farmers to visit their farms the following season. A farmer who desired the services of the specialists signified his willingness also to contribute his share of the travel expense. Not less than three hours was spent with him in analyzing his farm-management plans. At the close of the conference a written memorandum is left with him suggesting plans for improvement. Two men have visited 211 farmers in 12 counties in the central part of the State. Their analysis has not been made in detail, as has been done by the regular farm-management demonstrator. Night meetings are held at schoolhouses, at which talks are given on soil and crop improvement.

The specialists in horticulture and entomology in the development of their work have secured agreements, signed by the owners of orchards, stating exactly the nature of the work to be undertaken. The extension division furnishes the demonstrator, and the owner

furnishes meals and lodging for the demonstrator during the work. Pruning, spraying, and clean cultivation were the main features. Twenty-five contracts were entered into and completed last year. Visiting farmers met at the orchards from one to three times during the growing season. A cultivation demonstration in an orchard near Grantville was so striking that the difference in the color of the foliage of the portion of the orchard cultivated according to directions and of the portion handled in the usual manner was easily seen from a distance of over half a mile. In addition to the work with 25 demonstration orchards, 220 visits were made to other farms, where one-day demonstrations in pruning and spraying were conducted. The attendance at these demonstrations was 3,122. The entomologist assisted in the control of the army worm on farms by instructing 237 farmers in the use of poison-bran mash. More than 200 farmers in one county used the bran mash to control army worms with success. Demonstration meetings were held on farms in the southwestern section of the State for the control of Hessian fly and grasshoppers by means of the same methods.

From March to September the poultry instructor conducted 12 2-day poultry schools, which from 12 to 20 persons attended, respectively. Poultry farms are also visited and individual instruction given. Topics discussed at the schools included poultry diseases, housing, and marketing, accompanied by demonstrations in caponizing, dressing poultry, and preparing it for market. Plans for poultry houses are prepared for those requesting them.

The dairy specialist has visited dairy farms, creameries, condenseries, and cream stations to assist farmers and creamery managers in the handling of dairies and dairy products. Much of this work has been in the eastern section of the State from which milk is supplied to the Kansas City market. Seventy-five farms have been visited to give instruction as to barn and milk-house improvements necessary to meet the provisions of the Kansas City ordinances regulating the marketing of milk. As a result, the majority of these dairies produce grade A milk and receive a premium of from 2 to 3 cents a gallon.

OTHER EXTENSION WORK.

Farmers' institutes are in charge of a superintendent of institutes who arranges a definite program covering the work to be conducted in the 440 State organizations. Each organization has a constitution and by-laws and is supposed to hold at least three meetings in addition to the annual meeting. The annual institute meetings are held from October to March. Three hundred and ninety-seven institutes were visited by specialists from the agricultural college; the total attendance at the annual meetings was 93,713. Farm visiting by

agricultural specialists is one of the features of the annual meetings. The plan of conducting this work has already been referred to.

A department of highway engineering in charge of a highway engineer was organized to give instruction to farmers and others as to the economic value of good roads and bridges. Plans for permanent roads and bridges are prepared in the engineering office on the request of county commissioners. Inspection of bridges constructed according to the State engineer's plans is also made. Advice was given on the construction of 476 bridges in 76 counties. Lectures on drainage and irrigation are made at farmers' institutes, and specific help is given to individual farmers.

In the correspondence study department 124 courses are offered in agriculture, home economics, mechanic arts, farm engineering, and many high-school subjects. The courses offered are known as reading courses, extension courses, and credit courses. Reading courses are planned for the follow-up work to the farmers' institutes and extension schools. The extension courses are more comprehensive than the reading courses and deal with various lines of work offered at the college. Applicants are not required to meet the regular college entrance prerequisites. The credit courses are made as nearly as possible to cover the work offered in residence. On completion of the work an examination is given and credit is issued. A fee of $4 is charged for each subject taken in this course.

The purpose of the rural-service department is to awaken an interest in rural-community welfare. Where there are local welfare organizations the rural-service department has aimed to encourage the federation of organizations already existing. Five district rural conferences of from two to three days were conducted in as many communities for rural ministers, county superintendents, and teachers. Plans for community welfare work were presented at these conferences by specialists from the agricultural college as a feature of the summer school in July, 1914, and 200 persons, 66 of whom were ministers directly interested in rural pastorate work, attended. In connection with the correspondence study department a course in rural sociology has been conducted, and 137 rural ministers in the State have gone into the work. The results of this work, although intangible, have been to awaken a general interest throughout the State in rural-community welfare.

Boys' and girls' clubs.—Ten different kinds of boys' and girls' clubs were organized during the spring of 1915 and work was conducted along the following lines: Raising corn, sorghum, pigs, poultry, tomatoes and potatoes, gardening and canning, cooking, sewing, and farm and home handicraft. This work was conducted under a State leader of boys and girls clubs and was closely related with other departments of the extension division. All follow-up work and in-

structions of a technical nature are approved by the subject-matter department of the college before they are mailed to club members. During the year 247 clubs have been organized in the State, 805 members completed all the work required of them during the season, and 265 boys and girls who were winners in contests attended the State farmers' institute at the college for one week and were instructed in agriculture and home-economics subjects.

Extension schools.—During the year eight agricultural-extension schools of five days each were conducted. Three agricultural specialists and one home-economics specialist constituted the teaching staff. Each agricultural specialist gave a series of 10 lessons, which were illustrated with charts and with demonstrations in live-stock judging. The average attendance at these schools was 120.

Farm-management demonstrations.—Farm-management demonstration work was begun in this State September 1, 1914, through cooperation between the United States Department of Agriculture and the Kansas State Agricultural College. The work is conducted principally in those counties having agents in order that the resulting recommendations may be followed up by them. Three hundred and forty-five farm analysis records have been made, 144 of which have been returned to the farmers with suggestions for revisions in the management of their business. County agents have called during the winter season to discuss records with farmers. Twenty-seven farmers have agreed to keep farm accounts.

Drainage and irrigation.—The drainage and irrigation specialist has assisted in the forming of 5 drainage districts of 31,670 acres and made 14 visits to districts already formed. Individual visits were made to 26 farms to advise on farm-drainage problems. Assistance was given in the laying out of drainage systems, preparing plans, contracts, and specifications. During the year approximately $176,000 worth of drainage work has been handled, of which $130,000 is credited directly to drainage districts where complete plans, specifications, and systems of the work were made.

OUTLOOK.

The necessity for a definite plan for financing the county farm bureau has been met by the enactment of a law providing for a county plan of organization and for county funds with which to support the work in cooperation with the State agricultural college and the United States Department of Agriculture. This work is going forward satisfactorily.

The work of the various specialists is being organized in close cooperation with that of the county and district agents. The extension division has the extension work of both the State and this department well in hand, and a feeling of unity of effort and team work prevails throughout the force.

MAINE.

Division of Agricultural Extension, College of Agriculture, University of Maine, *Orono.*

LEON S. MERRILL, *Director.*

History.—In 1832 the Maine Legislature passed an act to encourage the introduction or improvement of " any breed of cattle useful to the State or any tools or implements of husbandry or manufacture, introducing or preserving any available trees, shrubs, or plants, or in any way encouraging or advancing any of the departments of agriculture, horticulture, or manufacture." Under the impetus of this act farmers entered into competition for the prizes offered, reporting in detail the methods followed in the production of animals and crop products entered for competition. In 1852 the legislature provided for the organization of a State board of agriculture, and in 1882 made provision by an annual appropriation of $1,400 for the holding of farmers' institutes. The board of agriculture published annual reports from 1855 to 1902, since which time the State department of agriculture continued the publication of yearly reports. The work of conducting farmers' institutes contained in charge of the commissioner of agriculture with slightly increased appropriations. The department has had other duties added to it, including extension work in seed improvement and dairying.

The college of agriculture of the University of Maine began extension work in 1892. This consisted of lectures, publications, correspondence courses, and the giving of information and advice by letter in answer to inquiries. In 1893 local extension schools were added. This work was done by the regular teaching staff of the college until 1907, when a man was employed to give his full time to extension work. The terms of the Smith-Lever Act were accepted by the governor on June 2, 1914, and were formally approved by the legislature on March 8, 1915. The conditions of the act were met by the appropriation of $4,389 for the fiscal year ending June 30, 1916, and $8,047 for the following year.

Organization and administration.—The extension division of the college of agriculture of the University of Maine is under the supervision of a director who is also dean of the college. An assistant director is in immediate charge of much of the extension work. Leaders of county-agent and club work are in charge of these special projects, and specialists are employed in home-economics and soil-fertility work. The assistant director has immediate charge of the dairy-extension project. The extension director has the academic rank of a full professor in the college, the assistant that of an assistant professor, and the other members of the extension staff rank as

instructors. The extension division has no direct connection with the experiment station.

Publications and mailing list.—During the year 11 extension bulletins were published. A total of 52,100 copies were printed. In addition, circulars and circular letters amounting to several thousand pages were issued. Press notices have been furnished to call attention to each publication as issued, and publications have been freely sent to all applicants. An unclassified mailing list of about 4,000 names has been compiled. The bulletins were prepared by specialists in subject matter, and the circular letters were written by members of the extension staff.

Finances.—The sources and amounts of the several funds used in cooperative extension work of agriculture and home economics are shown below:

Smith-Lever fund	$10,000
University funds	6,550
United States Department of Agriculture, farmers' cooperative demonstration work	1,360
Other funds	19,500
Total	37,410

The Smith-Lever fund was used chiefly for the support of county-agent work in three counties, a small part being used for administration expenses and publications. The United States Department of Agriculture cooperated by furnishing funds for the support in part of farm-management demonstrations. A report showing in detail the expenditures of these funds has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—The extension director acted as county agent leader, but was paid entirely from university funds. None of the county agents received salary direct from the United States Department of Agriculture. In three counties they receive their entire support from the Smith-Lever fund. The county agent is recognized as the center of extension activities in his county, and all agricultural work planned by the college to be done in his county is carried on with the county agent's knowledge and approval.

There is a strong belief in Maine that the county agent, as well as all other public-service workers, should be supported at the expense of the general public through State and Federal appropriation. Therefore there have been no local contributions for the support of county agents, except that in a few cases office room is provided.

During the year the county agents in the counties of Franklin, York, and Sagadahoc enlisted the cooperation of 93 demonstrators who have carried on 106 economic-production demonstrations on

which detailed cost accounts were obtained. These agents made 1,171 calls on demonstrators and visited 687 farmers for inquiry, gave special information and advice on 150 farm problems, and visited 494 other persons in connection with county extension work. They were called on at their offices by 60 farmers, and lectured at a total of 88 meetings at which there was an attendance of 3,210 persons.

They assisted in 9 extension schools consisting of 48 sessions and having a total attendance of 1,360. They also attended 9 extension schools in other counties in exchange for outside help, these schools having had an attendance of 1,180 at 48 sessions. Help was given in the organization of 3 cow-testing associations, 1 farmers' union, and 2 neighborhood clubs. Specialists from the college visited 665 farmers, delivered lectures at 273 meetings attended by 22,008 persons, assisted in conducting 28 extension schools with a total attendance of 5,476, and conducted demonstrations attended by 9,926 persons.

It thus appears that representatives of the extension service visited 1,445 farmers in these 3 counties; that they delivered 361 lectures, and reached a total of more than 40,000 persons.

OTHER EXTENSION WORK.

During the year $19,500 was received from sources outside the State for the support of extension work in Maine. With this fund demonstration work was carried on by means of county agents in six counties, and boys' and girls' club work was conducted throughout the State.

The State department of agriculture has a fund of about $3,000 for dairy-extension work and $2,300 for farmers' institutes. It has also approximately $3,000 for carrying on seed-improvement work. The extension division of the college cooperates with the State department in these activities. The Maine Federation of Agricultural Associations, with representation from every agricultural organization in the State, gave active cooperation to extension activities.

Farm-management demonstrations. — Farm-management demonstration work was begun in Maine on October 19, 1914, under an agreement with the United States Department of Agriculture providing that the extension service of Maine should pay half of the expenses after June 30, 1915. Up to that date, 470 farm-analysis records had been taken in 5 counties and 61 returned to as many farmers in one county.

OUTLOOK.

There seems to be a strong demand throughout the State for county agents, and it is believed that, as soon as funds become available, a county agent can be established in every county in the State.

The distinctive feature of county-agent work in Maine would seem to be a less number of demonstrations but with more complete records of the demonstrations made, showing costs and financial returns. This feature seems to appeal strongly to the farmer.

The boys' and girls' club work of the State, the movable-school work, and the work of the specialists seems to be well coordinated and all working out effectually in the interests of Maine agriculture.

MASSACHUSETTS.

Division of Extension Service, Massachusetts Agricultural College, *Amherst.*

WILLIAM D. HURD, *Director.*

History.—The Massachusetts State Board of Agriculture was created in April, 1852. At a meeting held on September 7 of that year a committee of the board was appointed to report means of promoting agriculture by means of lectures, and on December 1 of the same year this committee reported in favor of calling the attention of the people of the Commonwealth to the importance of having lectures on agriculture as a part of the lyceum lecture courses then popular in rural districts.

In the fall of 1863 the first three-day meeting of the State board of agriculture was held for lectures and discussions. In 1878 the board voted that agricultural societies receiving bounties from the Commonwealth should be asked to arrange for one or more institutes each year, and in 1879 the board voted to require the holding of three institutes by each society. These institutes were addressed by members of the board, whose traveling expenses were paid out of State appropriations. In 1888 the first State appropriation was made to pay institute workers.

The first appropriation by the State legislature for the support of agricultural-extension work to be conducted by the agricultural college was made in 1909. This appropriation of $7,500 was made for short courses and extension work. The short courses were held at the college, and the extension work was conducted in the communities away from the seat of the college. In September, 1909, an extension director was appointed and a formal plan of conducting extension work adopted by the Massachusetts Agricultural College; previously lectures had been given by members of the college and station staff, who had responded to calls from the State board of agriculture, from the State grange, and from subordinate granges, and farmers' clubs throughout the State. County-agent work began with the appointment on September 1, 1912, of a State leader under a cooperative agreement between the Massachusetts Agricultural College and the

United States Department of Agriculture. On May 12, 1913, after the organization of a farm union in Hampden County, two agents were appointed. Boys' and girls' club work had been on a basis of cooperation with the United States Department of Agriculture since February 15, 1913. Home-economics extension work was begun July 1, 1913. The provisions of the Smith-Lever Act were adopted by the general assembly on June 29, 1914.

Organization and administration.—The extension director is responsible to the president of the college. The extension division is coordinate in rank with the experiment station and is similarly organized. Specialists of the extension staff are directly attached to college departments to which they are responsible for the subject matter of their teaching. They are responsible to the extension director for the disposition of their time and the arrangement of their work. All members of the extension staff make weekly reports to the director, give the places and nature of the work done during the week, and also include an itinerary for the following week. The specialists in carrying out their projects are expected to make their own plans and to arrange for meetings and to accept invitations to perform special service or to lecture before granges or other organizations. In each case the specialist notifies the director of his plans and is at liberty to carry them out according to his own judgment unless further advised by the director.

Mailing lists and publications.—The extension division issues a monthly publication called Facts for Farmers of which 12 numbers were issued during the year in editions averaging 3,400 copies. Three numbers of a bulletin for farm women were published in editions ranging from 4,000 to 6,500 copies; five primers for boys and girls with a supplement to one of them; three primers dealing especially with pork production, egg production, and market gardening; a bulletin on breeding and rearing chicks; and the biennial report of the extension service were the most important publications. Besides these publications, circulars, record blanks, and a number of leaflets were printed. A regular biweekly news letter is sent to about 200 State papers; 15 special news letters were issued during the year; and 40 lecture abstracts and 10 special articles were prepared.

The various members of the college, station, and extension staffs are encouraged to prepare timely articles for publication. After a manuscript has been prepared, the subject matter is criticized by the heads of the interested departments. The general mailing list includes about 1,000 names. In addition there are other classified lists of persons who are supplied with publications in which they have especial interest.

Finances.—Funds entering into cooperative extension work for the year ended June 30, 1915, were as follows:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	11,572
State appropriation	50,000
County and other funds	45,000
Total	116,572

The Smith-Lever funds were used in financing different projects: County-agent work, boys' and girls' club work, animal husbandry, dairying, home economics, fruit growing, and demonstrations by means of an auto truck. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of farm-management demonstrations, county agents, and boys' and girls' clubs.

A detailed financial statement has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—The first agents began work in May, 1913, when two men were employed in Hampden County.

Ten counties were organized in 1914–15, six of which employ two or more men each, which makes possible a division of the work according to subject matter. In each county an association has been created to support the work. In nine counties the work is on a definite project basis. A State federation of farm bureaus has been organized. Cooperative relations are maintained with the State board of education and local agricultural high schools.

Boys' and girls' clubs.—Boys' and girls' club work is developing rapidly. There is a call to expand the work faster than it can be thoroughly supervised. During the year 1914–15 clubs have reached a total enrollment of 64,500. Of this number about 50,000 are members of home-garden clubs. With an enrollment of 500 in the pig clubs, 175 boys completed all prescribed work, including detailed records of the rearing and feeding to maturity of one pig. One bank purchased 174 pigs, selling them to the boys at $4.25 and taking notes at 6 per cent interest in payment. The same bank offered to lend money for the purchase of one-half ton of fertilizer or for the purchase of seeds to enable the club members to carry through their plans. Club work in Massachusetts has developed in hearty cooperation with the schools. In some cases the schools employed local leaders to have charge of the work during the summer vacations.

Home economics.—Three projects were continued from the previous year and have been greatly strengthened: Extension schools, canning demonstrations, and boys' and girls' home-economics clubs. The extension schools are held from November to March, each con-

sisting of lectures and demonstrations covering five-day periods with morning and afternoon sessions. Question lists have been prepared to be used in following up the instruction given at the schools. Canning demonstrations have been given before granges, parent-teacher associations, and teachers' meetings. The first three numbers of a series of home-economics bulletins were issued. A special demonstration project with a local agent in charge was conducted during April, May, and June in the town of Brimfield. In the home-economics clubs 1,200 boys and girls have been enrolled.

Auto-truck demonstrations.—A large truck, equipped with tanks and spraying apparatus, was taken to a number of places by a college demonstrator, who brought farmers together for the purpose of illustrating methods of pruning and spraying fruit trees. The same demonstrator gave instruction in operating dairy machinery, laying out fertilizer-demonstration plats, and the keeping of dairy and farm-management records. Sixty lectures and demonstrations were given with a total attendance of 1,705.

Demonstrations in fruit growing.—About six years ago an orchard-management project was started by the college. Contracts were made under which 16 orchards have been planted and are being cared for under the supervision of the department of pomology. The contract provides that the college shall furnish and help to plant the trees on land selected by a representative of the department of pomology and the owner of the land. It provides, also, that the farmer shall cultivate and otherwise care for the orchard and provide necessary fertilizers as they may be needed. Continuous supervision is provided by the college.

The work under this project seems to be progressing favorably. Meetings are held each year at each of these demonstration orchards at the time of spraying and pruning; also, where fruit is being produced, at the time of picking. The immediate neighbors of the owner are notified of the date of the meeting. The college furnishes a spraying outfit, which is located at each demonstration orchard for use by the owner and by his neighbors. Thus, the owner of the demonstration orchard becomes a source of information for the neighborhood and is led to feel that he is a representative of the college in carrying forward its plans for teaching better orchard management.

Animal husbandry.—Fourteen stock-judging contests for boys under 18 were held. Most of the work under this project consisted of instruction given at extension schools and by means of special lectures and demonstrations.

Dairying.—The dairy department organized three milk shows during the year. These shows were held in cooperation with milk inspectors. Relations have been established with about 4,000 pro-

ducers and handlers of market milk. More than 500 samples of milk and cream were tested at shows and fairs. A large number of lectures were given and a number of special conferences were held. At the college laboratories analyses are made and milk tested for bacteria. Boards of health have cooperated. Samples scoring above 85 per cent are publicly announced.

OTHER EXTENSION WORK.

The State board of agriculture has charge of all farmers' institute work in the State. The extension division cooperates with the board and with other agencies that are interested in promoting rural education and cooperation between town and country in the development of mutually helpful relationships.

Farm-management demonstrations.—Eleven areas in seven different counties have had the benefit of farm-management demonstrations, and in one of these areas the work has been conducted for three years. During the year there were taken 637 first-year records, 158 second-year records, and 39 third-year records. As a result, returns were made to 13 farmers by letter and to 442 in person. Forty-six farmers were planning changes in their farm organization as a result of the demonstrations, and of these 45 had been visited for consultation in regard to improvements.

Demonstrations at fairs.—During the fair season, nine fairs were visited with the college exhibit, which was installed in a large tent belonging to the college. At these fairs, 121 lectures and demonstrations were given with a total attendance of 9,750. The total attendance at the exhibit tent was 73,000.

Extension schools.—Fourteen extension schools were held during the winter months. Practically all of the extension leaders and specialists give their entire time to the schools during this season. The aim is to make the instruction of these schools systematic throughout a period of five days. Schools usually continue from Monday noon until Friday night. Each lecturer is provided with demonstration material to illustrate his talk. Syllabi of all lectures are furnished to members of the school.

Lectures.—A large number of special lectures were given, usually on the invitation of granges' and farmers' associations. The extension division is emphasizing the importance of giving courses of lectures rather than single lectures. The single lecture is too often received as if it were intended for entertainment rather than instruction, whereas the series of lectures is accepted as definitely instructional.

Correspondence courses.—During the year 18 correspondence courses have been developed in which 759 students were enrolled at

the close of the fiscal year 1914–15. Lessons are prepared by members of the college and station staffs. The plan is to follow up the work of correspondence students so as to know that actual study is being done.

Beekeeping.—Extension work in beekeeping is carried on in cooperation with the college and experiment station and the State board of agriculture. Much of this work is of an investigational character. Part of it is purely inspection work. The actual teaching is done chiefly as a result of the information secured on the visits to beekeepers, most of which are made to examine into the health of the colonies.

Agricultural economics.—Under this project a number of credit associations have been organized, and farmers and bankers have been brought together in such ways as to enable farmers to secure money at reasonable interest rates. Strawberry growers of Barnstable County were assisted in forming a cooperative organization. This is only one of sixteen cooperative organizations that have been developed. The cultivation of a mutual understanding between farmers and bankers seems to mark a real advance in the effort to solve the problem of rural credit.

Community planning.—This unusual form of extension work consists of giving information and leadership to such communities as are interested in constructive organization and work for community improvement. County agents and high-school teachers of agriculture are assisted in studying their local problems. Use is made of the Massachusetts Federation for Rural Progress. Four extension schools for community planning were held. Follow-up work has been carried on in 14 communities which had previously begun long-term plans of development. This project is carried on in cooperation with the State board of education.

OUTLOOK.

The tendency is to make much use of the extension service. The demands for service are so great that there seems to be danger that more work in many lines of effort will be undertaken than can be carried to a successful termination with the funds and organization available. Notwithstanding the strong impetus given to cooperative effort through the leadership of the college, there is a noticeable tendency to independence of effort in a number of the counties. Emphasis needs to be placed upon the importance of genuine cooperation by the various State and independent agencies established for promoting better agriculture and better social conditions throughout the rural districts. At the same time emphasis needs

to be placed upon the interdependence of the various agencies working for the improvement of agricultural conditions.

MICHIGAN.

Division of Extension, Michigan Agricultural College, *East Lansing.*

R. J. Baldwin, *Director.*

History.—In 1861 the State legislature passed a law providing for lectures upon farm topics to others than college students. In 1876 a small appropriation was made by the State board of agriculture for conducting farmers' institutes, the speakers being supplied principally by the college of agriculture. For 12 years only 6 institutes were held annually, but were increased to 22 in 1891, at which time direction of farmers' institutes was placed in the hands of one member of the State board of agriculture. In 1895 the State appropriated $5,000 for farmers' institutes, and the State board of agriculture selected a superintendent of institutes. This law provided for two-day institutes in any county forming an institute society and making a formal request. Speakers were furnished from the college as long as sufficient men were available, then successful farmers were employed. It was a practice at this time for the superintendent of institutes to visit the homes of the speakers to look into methods used by them. The policy of employing special extension workers was established in 1906, when a man was appointed to improve live stock through the community breeders' association; success in this plan resulted in his permanent appointment in 1908, to give his entire time to extension work. Other extension specialists in farm crops and horticulture were appointed soon after the work in the improvement of live stock began; these persons were responsible to subject-matter departments within the college and worked in the field as their representatives. The first county agent cooperatively employed with the United States Department of Agriculture began work on July 1, 1912. The junior extension work was started by the college in 1912 for the purpose of encouraging the adoption of agricultural courses in high schools. On December 1, 1913, the first boys' and girls' clubs doing work under cooperative plans between the United States Department of Agriculture and the college were organized. The governor assented to the Smith-Lever Act prior to June 12, 1914, and the general assembly accepted its terms April 21, 1915.

Organization and administration.—The extension division as now organized is coordinate with the various other divisions of the college and administratively independent of the department of agriculture of the college, the director reporting directly to the president instead of the dean as is commonly the case. The director is assisted in conducting work by a county-agent leader, State leader of boys' and

girls' clubs, superintendent of farmers' institutes, market director, and 12 specialists, representing the following college departments: Agricultural education, animal husbandry, dairying, farm engineering, forestry, farm crops, home economics, and horticulture. These persons are all administratively responsible to the extension director, but specalists are located within the instructional departments of the college and are responsible to the heads of their respective departments for the subject matter taught. Each extension specialist develops the work in a definite project formulated by him, the head of the department concerned, and the extension director. There are 15 county agents who report directly to the county-agent leader. There are 12 persons, not including county agents, who give their entire time to extension work, and 10 persons, besides those on the college and station staff not paid from extension funds, who spend less than half time for extension work.

Mailing list and publications.—During the year 13 publications dealing with extension reports for club work and home economics were issued.

A separate mailing list is not maintained for the extension division. The 25,000 names on the mailing list of the experiment station are used, but not all publications are sent to the entire list. Letters of inquiry are referred to each subject-matter department and replies are mailed under postage.

Finances.—The following funds were available for cooperative extension work for the fiscal year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	17,376
United States Department of Agriculture, Bureau of Animal Industry	800
College	16,845
County appropriation	19,540
Total	64,561

Smith-Lever funds were used in support of the work for county agents, home economics, boys' and girls' clubs, horticultural demonstrations, farm-management demonstrations, household engineering, farm-crop demonstration, and a special project in general agricultural extension for the upper peninsula. The Federal Smith-Lever funds, first sent to the State treasurer, are now sent direct to the college. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: County agents; boys' and girls' clubs; farm-management demonstrations; cow testing; and dairy farming.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 11 county agents and on June 30, 1915, there were 15. Bureaus or federations have been organized to support the county agent in his work. Various organizations of farmers, bankers, chambers of commerce, etc., also assisted in giving moral support to the work of the agent. Perhaps one of the more important phases of the work of the county agent has been preventing the spread of foot-and-mouth disease and hog cholera. Other organized efforts have been directed toward the development of the live-stock industry through the formation of associations of cattle breeders, in dairying and beef production, of cow-testing associations, and live-stock shipping associations. In almost every county where there is an agent potato associations have been formed. These organizations have adopted one or two standard commercial varieties and concentrated their efforts to keeping these true to type and free from diseases, with a view to carefully grading and marketing. The county agents in the bean-growing section also aided in the formation of a State bean-growers' association. The work begun the previous year has been continued, and emphasis has been placed upon securing the seed more nearly free from disease and bringing about a better method of marketing the crop. All county agents have emphasized the need of pedigreed seeds and varieties adapted to local soil and climatic conditions and of the standardization of varieties to meet the market conditions. Two hundred and twenty marl beds have been located and developed, thereby affording an excellent local supply of lime, which many of the soils of the State need. In the campaign to interest farmers in the growing of legumes, both for soil-building and feeding purposes, greatest progress has been made in the growing of alfalfa.

Some of the important features of the work of the county agent in relation to the farm and farmstead follow: Farm buildings planned or improved, 115; silos constructed, 657; water supply introduced or improved, 46; crop rotations planned, 287; drainage systems planned, 36. In relation to crops: Farmers selecting seed corn in fall, 704; farms on which seed oats are treated to prevent smut, 515; farmers planting hill-selected seed potatoes, 217; farms on which the agent knows alfalfa was sown following his suggestions, 1,056; and orchards cared for in whole or in part, 240. In relation to live stock: Registered male animals which the agent knows were secured on his suggestion, 106; registered female animals secured, 128; registered sires transferred from one community to another, 7; cow-testing associations organized by the agent, 6; cows tested for milk production through these associations, 834; cows tested for milk production by individuals on suggestion of

agent, 987; live-stock breeding associations organized by the agent, 15; farms on which balanced rations figured by the county agent are known to have been adopted, 206; animals tested for tuberculosis by the agent, 577; hogs vaccinated for cholera by the agent, 3,235; hogs vaccinated by veterinarians or farmers on agent's recommendation, 541. In relation to fertilizers and fertility: Farmers reenforcing manure with acid phosphate or floats, 177; tons of lime or limestone used, 13,678; acres of vetch plowed under for green manure, 4,341; and number of farms on which agent tested the soil for acidity, 1,202. In relation to farm business: Farms which the agent knows have been reorganized as a result of farm-management demonstrations, 46; farmers induced by the agent to keep farm accounts, 124.

County-agent work in upper peninsula.—During the year attention has been given to the advancement of potato industry, live-stock improvement, the introduction of improved varieties of grains and forage crops, and the culture of fruit. Assistance has also been given to problems of land clearing, drainage, and maintenance of soil fertility. During the planting season a number of plats conspicuously located were started to demonstrate the use of formalin as a means of controlling potato diseases, the value of fertilizers on new lands, the value of tillage, and the value of selected pure seed. As a means of live-stock improvement, 9 cooperative breeders' associations have been organized. More than 25 pure-bred sires were placed during the year. Over 500 ewes have been placed in various parts of the upper peninsula through the influence of the leader of this project. The extension specialists have visited farms and given instructions in the care and management of dairy cows, sheep, and hogs. One feature in the improvement of farm crops has been the distribution of 1,500 bushels of Worthy oats, which seem to be well adapted to this region. Alexander oats has also been widely distributed. Both varieties were supplied through the college and were placed in the hands of good farmers who would grow them according to instructions. As a means to improve apple orchards, demonstrations in planting, pruning, spraying, cultivating, and marketing have been made.

Household engineering.—The specialist in household engineering is giving particular attention to the improvement of the water system and sewage-disposal facilities in farm homes. Interest in the work was at first secured by holding a series of meetings in counties having agents, at which full information was given as to plans, expense, etc., of installing water and sewage systems. Personal visits were later made to homes of all who expressed a desire for assistance. In all cases recommendations were made in accordance with financial and other conditions found. Wherever possible a community meet-

ing was held to inspect installations made. Septic tanks and piping were left uncovered that neighbors could see and ask questions about them. During two months' work with county agents, 18 sets of plans were furnished and 5 septic tanks were installed. Along with this work samples of well water were sent to the college for analysis. Nine out of every ten samples were found to be polluted with sewage.

Boys' and girls' clubs.—Boys' and girls' clubs are under the leadership of one man, who gives his entire time to organizing and developing the work. In most cases this project is closely related to the work of the public schools, and wherever possible the school-teacher acts as leader for the local club. The following projects for boys have been promoted during the past year: Corn, potato, bean, alfalfa, vegetable, poultry, and live-stock growing. For girls: Garment making, gardening, canning, poultry raising, and housekeeping. Under these projects there were enrolled 4,252 boys and girls. The most successful of these projects conducted were the corn and potato growing for boys; and gardening, canning, and garment making for girls. Occasionally the county agents and the extension specialists from the college meet with the club members for instructional and demonstration work.

Horticultural work.—The extension work in horticulture was conducted along two lines, one in orchard management and the other in the growing of vegetables. In orchards demonstrations were made in pruning, spraying, use of cover crops, and harvesting. Special demonstrations were made in thinning, grading, and packing of fruit. At two large fairs an educational exhibit of fruit, orchard appliances, spray materials and equipment, and orchard pests was shown. The person in charge of this work was further occupied in giving courses in extension schools, attending horticultural societies, granges, and farmers' clubs. The leader of the work in vegetable growing gave three-fifths of his time to extension work on potatoes and two-fifths to greenhouse and outside vegetables. The potato work was conducted principally with the county potato associations and their various branches. Most of these branches were formed in counties having agents. Demonstrations were given in the treatment of potatoes to prevent scab and rhizoctonia. Field inspections are also made to assist farmers in identifying common diseases of the potato. These three inspections are made: First, when the plants are in bloom; second, before the plants die; and third, after the potatoes are dug. Demonstrations in various cultural methods for potatoes are also made. The inspection work is conducted principally in cooperation with the county agents. In the greenhouse work frequent visits are made to advise growers on various problems connected with their work.

Farm-management demonstrations.—Farm-management demonstrations were begun in July, 1914, by an assistant to the State leader. The county agent assisted in each case in collecting records and returning them to the individual farmers. During the year 447 records have been taken. Two hundred and eighty-four of these records were completed, and 223 have been returned to farmers with recommendations as to revisions in the method of conducting their farm operations.

Farm-crop demonstrations.—The specialist in farm crops devoted most of his time to securing and distributing pedigreed seed. There were 44 seed-distribution organizations with a membership of 760, through which improved varieties of wheat, rye, oats, barley, corn, soy beans, and potatoes are distributed. Red Rock wheat originated in the college and was distributed during the past two years. The progress of the improved seed work is shown by the fact that orders for nearly 2,500 bushels of pedigreed or improved seeds have been received and referred to the grower, and orders for thousands of bushels additional have been received and filled direct by the grower. A number of alfalfa clubs have been visited during the year. Most of the farmers belonging to these clubs have been successful in securing good stands of alfalfa and no longer require the assistance of the college in the growing of this crop. During the year a number of farm-crop exhibits have been furnished high schools where agriculture is taught, and seeds have been sent for planting high-school demonstration plats, with instructions for planting the same.

Home economics.—During the past year extension work in home economics has been in charge of one woman and two assistants. Twelve home-economics schools were conducted during the winter months, 8 of which were held for 1 week and 4 for 3 days each. In these schools courses in the preparation of foods, kitchen equipment, and other household appliances, home decoration, and the study of textiles were given. The total attendance was 922, the average attendance at each session 42. Sixty-five lectures and 48 demonstrations were given. Lectures have also been given at the county normal training schools for teachers, at which the subjects presented in the extension schools were also discussed.

OTHER EXTENSION WORK.

Extension schools.—Extension schools of from three to five days' duration were conducted from December 1 to March 1. Two courses which most nearly met the wishes and needs of the community are given in each school. Instruction was by means of lectures and demonstrations so far as the latter method permitted itself to be used. Illustrative material, including charts, specimen samples,

rations, orchard equipment, gasoline engines, and models of farm structures were used. Wherever possible, farm produce and live stock were brought to the school to be used for demonstration purposes. Forty-nine of these schools were held with a total attendance of 2,730. In one-fourth of these schools home-economics courses were conducted at the same time agricultural courses were being given.

Forestry.—Improvement of the farm wood lot has been demonstrated by the planting of 17 wood lots; 27 farmers have been induced to make plantings on unsightly places, using for the purpose forest trees suited to their soil conditions; farm windbreaks have been planted in the fruit belt where native timber is disappearing and where destruction from unchecked winds is increasing; 5 lake fronts and 11 sand areas that were not only drifting, but becoming serious menaces to adjoining valuable land, have been partly planted; 37 miles of roadside have been planted; 15,000 trees have been planted by clubs. An effort has been put forth to reforest large areas now useless for agricultural purposes. All available forest trees have been sold from the college nursery.

Live stock and dairying.—The animal husbandry and dairy specialists have given some attention to the organization of community breeders' associations. Three such organizations were completed during the year and two others are partially organized. Fifty-five extension lectures have been given by members of the college staff, at which there was an attendance of approximately 5,600. Cooperative work with the Bureau of Animal Industry has been carried on in maintaining and developing cow-testing associations.

OUTLOOK.

Michigan was one of the first of the Northern States to undertake county-agent work. It has consistently fostered its development since. The work is meeting the approval of the people of the State and is being supported in a substantial way by the legislature, the press, and the farmers. The extension force at the college have their work well outlined and are carrying it on in the field in close cooperation with the county agents and various agricultural societies and associations throughout the State. The administration of the work is orderly and effective.

MINNESOTA.

Agricultural Extension Division of the University of Minnesota, University Farm, *St. Paul.*

A. D. Wilson, *Director.*

History.—The first agricultural-extension work was farmers' institutes, which were established in Minnesota in 1886 by an act of the State legislature. In 1909 the Minnesota State legislature passed

an act appropriating money for and authorizing the establishment of the division of agricultural extension and home education, which was organized and began work January 1, 1910. The farmers' institute work and agricultural-extension work, while under different boards, are handled through the same office, as the director of agricultural extension is also superintendent of farmers' institutes. There is no State department of agriculture in Minnesota.

The county-agent work was begun in Minnesota in September, 1912. In 1913 the State legislature recognized the work by making a State appropriation in support of it and by authorizing boards of county commissioners to make appropriations to support it.

The governor gave his assent to the provisions of the Smith-Lever Act on June 25, 1914, and the legislature accepted the terms of the act April 17, 1915.

Organization and administration.—Agricultural-extension work in Minnesota is classified as one of three large divisions of the department of agriculture of the University of Minnesota. These three divisions are college of agriculture, experiment station, and agricultural extension.

The director of extension work reports to the dean of the department of agriculture and through him to the president of the university. The extension division has its separate faculty and separate officers. The chiefs of divisions of investigation and instruction serve in an advisory capacity to the director of extension in the selection of extension faculty members and in passing on subject matter to be given through the extension service. The director is assisted by an agricultural editor, county-agent leader, district county-agent supervisor, State leader and assistant State leader of boys' and girls' club work, two State agents in farm-management demonstrations, three home-economics field workers, two demonstration-farm specialists, and specialists in charge of rural schools, horticulture, live stock, poultry, dairying, farmers' clubs, soils, potatoes; and an office staff.

Eighteen people give full time and 12 people less than half time to extension work in addition to the county agents, and not including members of the subject-matter departments who handle occasional calls. Agricultural field workers are ranked the same as persons in similar positions in the subject-matter departments.

Mailing lists and publications.—Publications were printed on other than Smith-Lever funds. Popular extension bulletins are published, and from time to time special bulletins are published, as need arises, and sent to a special mailing list. The University Farm Press News is published semimonthly and sent to all papers in the State. The Rural School Agriculture is published monthly during the nine school months of the year and is sent to all rural-school teachers. Regular extension bulletins are sent to the 50,000 names on the ex-

periment-station mailing list. In addition to this a farmers' institute annual of 300 pages was published and 50,000 copies distributed. The issue this year was devoted to the farm home.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	16,218
United States Department of Agriculture, Bureau of Animal Industry	5,432
College appropriation	66,988
State appropriation	21,269
County appropriation	18,285
Local communities	6,450
Farmers' institutes	26,138
Total	170,780

The following projects were partially supported by Smith-Lever funds: Administration, county-agent work, demonstrations and lecture work in dairying, and extension schools. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, cow testing and dairy farming, and creamery-extension work. A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—At the close of the fiscal year of 1914–15, 23 counties employed agents, 4 counties having discontinued the work during the year. This work was financed by funds from Smith-Lever Act, United States Department of Agriculture, State, county, and some miscellaneous funds raised within the State. Some trouble has been experienced in maintaining the work in some counties, apparently because it was too largely controlled by business interests and because farmers did not clearly understand it. Some of these counties are being satisfactorily reorganized with the farmers more largely in control. The 1915 legislature, for reasons of economy, reduced the appropriation supporting general agriculture-extension work, and also the direct State aid to county agents.

The county agents visited 6,450 different farmers, and 9,635 farmers called on the county agent at his office on business in relation to his work; 1,965 meetings were addressed by the agents, with a total attendance of 113,775. One hundred and one organizations were formed by the county agents during the year, including antihog-cholera clubs, cow-testing associations, live-stock breeding associations, farmers' exchanges, and purchasing and marketing associa-

tions. The total membership of these associations was 6,096. The agents organized 166 boys' and girls' clubs during the year and assisted at 67 short courses, devoting 167 days to this work. The total enrollment at these courses was 8,216. Six hundred and twenty-four schools were visited by the agents, and 573 schools were assisted in developing agricultural instruction, 175 farm buildings were planned or improved, 289 silos constructed, 25 water-supply systems introduced or improved, 15 lighting systems installed, 3 heating systems installed, 71 home grounds planned or improved, 149 sanitary conditions improved, 218 crop-rotation systems planned, 390 drainage systems draining 24,549 acres planned, 15 miles of public road improved, and 18 ventilating systems planned at the suggestion of the agents.

One thousand four hundred and fifty-five farmers selected seed corn in the fall, and on 487 farms corn was grown following the suggestions of the agents. One hundred and forty-nine farmers planted hill-selected seed potatoes; potatoes were treated for scab on 643 farms, 237 farmers grew potatoes on the suggestions of the agents, 176 farmers grew hay, and 26 farmers grew sweet clover following the suggestions of the agents. On 349 farms seed or soil was inoculated for alfalfa; on 41 farms cowpeas were grown on the suggestion of the agents. Two hundred orchards were cared for in whole or in part following the advice of the county agent. Eight hundred and nine samples of seeds were germinated, 622 samples of seed were tested for purity, and 259 pupils cooperated in testing seed.

Eight hundred and fifty registered animals were secured on the suggestions of the agents and 838 animals other than pure bred were secured. Four cow-testing associations were formed, and 1,060 cows were tested for milk production through these associations. Three hundred and eighty-seven cows were tested for milk production by individuals on the suggestion of the agent. Ten thousand seven hundred and fifty one animals were treated for disease by the agent or on his suggestion.

Nine local sources of limestone were developed, 487 tons of lime or limestone were used, and 15 farmers made better use of barnyard manure following the agents' suggestions.

Two hundred and twenty-eight farm analysis records were taken by the agents, 480 farmers have been induced to keep partial or complete farm accounts, and 25 farms have been reorganized as a result of the farm analysis. The total value of all business done during the year by all associations organized by the agent or on his suggestion was $1,613,000, effecting an approximate saving of $35,800.

Dairying.—Two men were cooperatively employed by the extension division and the United States Department of Agriculture for

conducting farm-management demonstrations. Four hundred and seventy-five records were secured in 8 counties, 335 completed, 334 returned, and 305 farmers were induced to keep partial or complete accounts.

Cow-testing associations have been encouraged, and, in cooperation with the Dairy Division of the United States Department of Agriculture, 10 associations have been organized and supervised. Arrangements were made with the State library commission so that the farmers' clubs can obtain free circulating libraries containing 50 volumes, half of which were devoted to agricultural subjects and selected by the extension division. Package libraries devoted to special topics were also furnished by the library commission as helps to clubs in preparing their programs.

Extension schools.—Extension schools were held in 42 counties, reaching 9,100 people, of whom 5,235 were men and 3,865 women. Instruction was given along the lines of soil, dairy, and drainage improvement and home economics. The work with short courses was for the most part along the usual lecture lines, with a small amount of demonstration work. It is planned, however, the coming year to do much more demonstration work, including the actual installation of drainage systems, ventilating systems, and similar lines on farms owned or run by members of the school.

OTHER EXTENSION WORK.

Twenty-eight demonstration farms were operated under the supervision of the extension division. These farms are owned by the men who operate them, and no State money is put into them except for advice regarding their operation. Very satisfactory increased yields were obtained on these farms.

Cooperative organizations have grown out of the farmers' clubs, and the division has frequently been asked to assist in the organization and development of cooperative creameries, elevators, and livestock shipping associations.

Farmers' institutes were handled by the extension division under an appropriation made by the State. Ninety-three institutes were held, occupying 134 days with a total of 274 sessions. Sixteen lecturers addressed 48,710 people. All of these speakers came from outside the regular extension staff.

One man was employed full time to promote farmers' club work. On June 30, 1915, there were nearly 900 clubs in the State which were considered by the extension division as being one of the strongest forces for agricultural development. The meetings of the clubs are largely educational. A bulletin was prepared giving an outline for study and suitable programs for the clubs.

Boys' and girls' clubs.—Six hundred and thirty-three boys' and girls' clubs were formed during the year, with a total membership of 8,110; 6,776 actually began work, and 2,902 members completed the work required. Three thousand one hundred boys took part in the corn acre-yield contest; the highest yield secured was 88.6 bushels of dry-shelled corn. Eight hundred and fifty-seven boys took part in the potato acre-yield contest; the highest yield secured was 605 bushels. Two thousand one hundred and twenty-five girls took part in the bread-baking contest, and 156 girls took part in the pig-growing and canning contests.

Agricultural specialists.—One man was employed for dairy-extension work, giving his time to encouraging selection, care, and feeding of live stock, and also assisting in some of the creameries. Several of the weaker creameries were put on a more profitable basis.

OUTLOOK.

Extension work has a strong hold in Minnesota and is being largely used by the farmers. The reduction in the appropriation by the State legislature made it difficult to continue the work as efficiently as it had been previously on account of lack of funds for administrative purposes.

The county-agent work inaugurated at the outset on a comparatively large scale, and fostered by business interests, but with inadequate support from farmers, has met with difficulties and suspension of the work in several counties. Definite steps have been taken to make the work primarily a farmers' movement, supported and officered by farmers, with fair hopes of success.

The work of the farmers' clubs has been a powerful factor in developing extension work and in supporting the county-agent work.

MISSOURI.

Division of Agricultural Extension, College of Agriculture, University of Missouri, *Columbia.*

A. J. Meyer, *Secretary of Extension.*

History.—The first regularly organized farmers' institutes in Missouri were held in 1882 by the State board of agriculture, 18 years after its incorporation by the State legislature. Secretary Meyer states that the college of agriculture has conducted some form of extension work since its organization in 1870. An early reference to extension work is made by President R. H. Jesse in a small bulletin dated December 28, 1902, under the title, Public Service. President Jesse said, "Every chair in a State university should endeavor, so far as possible, to maintain four lines of work: (1) Teaching; (2) influence for good on students and institution; (3) research and

publication; and (4) public service. The public service should aid interests of the State outside of the university, and such interests only as can be reached by scientific skill. Such service should not be divorced from the purpose for which a university is maintained."

A detailed discussion of extension activities was included in the report of the experiment station for the year ended June 30, 1910. This report mentions a farmers' short course with an enrollment of 600 farmers; cooperation with the State board of agriculture in farmers' institutes and other agricultural meetings; 30,000 bulletins published for teachers in rural schools; farm-management demonstration meetings and demonstrations on farms in cooperation with the United States Department of Agriculture; organizing and instructing dairy associations and individual farmers; judging live stock at 35 county fairs, involving the examination of 6,027 animals for the placing of awards; correspondence, 40,000 letters and postal cards being received and answered during the year; the reaching of 28,000 people by agricultural trains; night schools at St. Louis and Kansas City attended by 2,300 persons; and boys' corn-growing contests with an enrollment of 3,000.

As an indication of the tendency in the development of extension work from 1910 to 1914, Secretary Meyer states that the policy has been (1) to systematize established lines rather than to start new activities; (2) to do more thorough work rather than try to reach greater numbers; (3) to decrease the proportion of lectures and increase the proportion of demonstration work; and (4) to recognize the farm home as an inseparable part of the farm business.

One month after the approval of the Smith-Lever bill, the curators of the University of Missouri established the agricultural-extension service as an administrative organization within the college of agriculture. On July 2, 1914, the governor accepted the provisions of the Smith-Lever Act, and on March 15, 1915, the legislature gave its formal assent to the same.

Organization and administration.—The administrative officials of the extension service include the president of the university, the dean of the college of agriculture, and the secretary of extension. The county-agent leader and three supervisors of club work have subordinate responsibilities in the administration of their lines of work. The entire staff of extension workers includes also 10 technical specialists and 15 county agents. The technical specialists are given academic rank within the college department with which they are associated, and they are expected to represent their departments' ideals in the extension field, but they are not members of the college faculty. While their teaching will accord with that of the department with which they are connected, their methods are expected

to be their own, and their time is entirely at the command of the extension service.

Publications and mailing list.—Two series of publications are used by the extension service—the project series which deals with extension activities, and the circular series which gives information on farm and farm-home problems. Four numbers of each have been published, the editions running from 8,000 to 18,000 copies. The classified mailing list of the experiment station, including 15,500 names, is used. The names of this list are classified to receive the publications falling within one or more of the following seven divisions: Economical fertilizers, dairy husbandry, animal husbandry, farm crops and soils, horticulture, poultry husbandry, and home economics.

Finances.—The extension division has received funds during the year as follows:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	11,033
State appropriation	32,015
College apportionment	651
County appropriation	17,410
Total	71,109

Smith-Lever funds were used in the support of five projects, namely, extension schools in home economics, boys' and girls' club work, hog-cholera eradication, dairy development, and poultry demonstrations. A small amount was also used for administrative expenses and for publications. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of county agents and farm-management demonstrations. A detailed report of all expenditures has been received and approved.

SMITH-LEVER PROJECTS.

Boys' and girls' clubs.—Club work for boys and girls was started March 1, 1914. At the beginning only corn and tomato clubs were organized. By the opening of the new fiscal year, July 1, 1914, there had been organized 41 tomato clubs with 347 members, and 55 corn clubs with 850 members. Later the work was expanded to include other club activities. Each member of a corn club was expected to plant 1 acre; members of tomato clubs planted a tenth of an acre for work on a commercial basis, otherwise not less than 10 plants; and members of other clubs were required to do sufficient work to give them a substantial knowledge of the work done and some skill in doing it. Four thousand four hundred and sixteen members began work in these clubs. Most of the projects were of such character that the work could not be completed during the fiscal period.

Home-economics extension schools.—Home-economics extension schools were planned for periods of from three to five days. Schools of one type, under the general direction of the county agents, were held during the summer months in country schoolhouses. All expenses of the schools of this type were provided locally. The fact that the people to be benefited paid all of the expenses seems to have had much to do with their success. Special teachers were engaged, the vacation season being such that home-economics teachers were readily available. Schools of the second type were different in organization rather than in subject matter of method of teaching. Demonstrations were given by the regular extension workers with assistance from the resident home-economics staff. The subjects receiving most attention were household sanitation, balancing the ration, the convenient house, the selection of material and making clothing, the cooking of vegetables, meat substitutes, cuts of meats and their preparation, house furnishings, feeding babies, canning vegetables, and related topics. These schools were held in eight counties having county agents and in seven other counties. In the former group there were 45 schools, with a total attendance for all sessions of 25,126; in the latter group the attendance was 330.

Hog-cholera eradication.—This project was undertaken to demonstrate how hog cholera may be eradicated by preventive measures and by serum treatment combined with sanitary methods. Most of the work was done in Bates, Cass, and Knox Counties, in which 59 hog-cholera clubs were organized. These clubs had a total membership of 1,887. Farmers to the number of 673 were visited, and 14,203 hogs were vaccinated. No definite results of the success of the vaccination treatment have been reported.

Dairying.—Dairying is an undeveloped industry in Missouri, many parts of the State never having developed to a commercial stage. For this reason it was necessary to promote development by lectures and extension schools. Emphasis has been placed on the need and means of herd improvement, and the building of silos has been encouraged, especially by furnishing plans with supervision at the beginning of construction. Some help has been given to creameries, the purpose being to secure better markets for farmers. Eighty public meetings were held in 25 counties, with an attendance of 9,681; 71 cooperators were secured, 143 farmers having been visited. Silo help was given in 40 counties. Ninety-four milk stations, creameries, ice-cream factories, and milk laboratories were visited.

Poultry.—The poultry project was planned to continue a system of egg-marketing clubs. It required much time and work to get these clubs reorganized and to keep them actively at work. During two months the margins above the ordinary price of eggs in one county amounted to $162.77. It was found that, to maintain interest in the

egg clubs, it was necessary to secure prices 3 cents above the ruling market price; also that a paid manager is needed to keep the work on a successful business basis. It appears to be necessary to maintain a campaign of education in order to keep the supply of eggs up to a maximum, especially when eggs are scarce and the prices highest.

OTHER EXTENSION WORK.

Farmers' institutes are under the direction of the State board of agriculture. They have no connection with the extension division of the college except as lecturers are occasionally sent to the institutes. A railroad company in the State has been active in extension work, six men being locally employed in the territory immediately tributary to its line. These men are doing work similar to that of the county agents. They have been especially active in promoting organizations of breeders, introducing improved live stock, and encouraging development of the dairy business. They have also conducted a large number of spraying demonstrations.

County agents.—County-agent work began in Cape Girardeau County August 1, 1912. At the beginning of the fiscal year 1914–15, 13 county agents were at work in as many counties, and by June 30, 1915, the number had increased to 15. Each county agent received $600 of his salary from the United States Department of Agriculture, the remainder being shared equally by the agricultural college and the county, the latter paying all office and traveling expenses. The work seems to have increased in effectiveness and to have become fairly well established in the confidence of the people. In the beginning, the farmers had comparatively little interest, but they have come to accept the county agent as their representative; and while the farmers are finding themselves in accord with the county agent's activities, the townsmen who had so enthusiastically promoted the work in the earlier days became of relatively decreasing influence in the conduct of the educational movement they were so influential in starting.

Three thousand five hundred and eighty-four farmers were visited by the agents in 4,658 farm visits and 15,822 farmers called on the agent at his office, on county-agent business. One thousand four hundred and seven meetings were held at wnich the agents addressed 109,163 persons. One hundred and sixteen associations were organized by the agents with a total membership of 2,501. These associations included farmers' exchanges, cow-testing associations, live-stock breeding associations, and purchasing and marketing associations. The agents devoted 83 days to 30 short courses, at which a total membership of 1,977 was enrolled.

Forty-seven farm-analysis records were taken by the agents, and 24 farmers have been induced to keep partial or complete accounts as the result of these analyses.

The total value of all business done during the year by all associations organized by the agent or on his suggestion was $16,569, effecting an approximate saving of $1,379.

Extension schools.—Twelve schools were held for the purpose of teaching particular phases of agriculture. Most of these were held through periods of five days. The average attendance was about 50. The work of instruction was chiefly by means of lectures. An attempt has been made by means of a letter of inquiry to learn from the farmers who attended these schools, what benefit they received from the instruction given, and how they modified their practices as a result of the new information received.

Farm-management demonstrations.—Farm-management demonstrations were carried on cooperatively with the United States Department of Agriculture for only a few months and then discontinued, the demonstrator taking up teaching work at the university. In the meanwhile 116 farm analysis records were taken in two areas in Jackson and Saline Counties, 113 of which were completed and returned to the farmers by letter. Seventy-nine of the 113 farmers were personally visited for the purpose of explaining the returns.

Miscellaneous farmers' meetings.—There is reported to be an insistent demand from all parts of the State for help at farmers' meetings of various kinds. These calls open a field for extension activities which the college has felt bound to heed. While these meetings are not farmers' institutes in the accepted meaning of that term, they partake largely of the institute form. The extension service tried to make use of these various meetings to promote its more definite extension projects. The expenses of these miscellaneous meetings are generally borne by the community or organization receiving the services. However, the salaries of the extension workers are paid directly from the extension funds.

OUTLOOK.

Extension work in Missouri seems to be developing along all the various lines of effort. The large amount of extension work which the college has heretofore promoted through extension specialists located at the college has been continued, but is being more closely coordinated with that of the county agent. The county-agent work is making progress slowly, but substantially.

MONTANA.

Division of Extension Service, Montana State College, *Bozeman.*

F. S. Cooley, *Director.*

History.—The first farmers' institutes were held in 1893 in 49 places, representing most of the counties of the State. The members of the experiment-station staff were the principal speakers at these meetings. In 1901 a State board of administration of farmers' institutes was provided for, to consist of the governor of the State, director of the experiment station, and the president of each of the following-named organizations. State wool-growers' association, live-stock association, horticultural society, agricultural association, and the dairymen's association. Two thousand dollars was appropriated for use in conducting farmers' institutes. No institute was entitled to more than $50. The secretary of the board of directors of the experiment station was also superintendent of farmers' institutes and had immediate charge of the work over the State. During the first two years under the new institute law it was found that the funds were not sufficient to meet the needs of the work, and in 1903 the amount of funds appropriated was increased to $4,000 per year. While the experiment station and college staff had been depended upon mainly for institute instruction, yet 15 or 20 practical farmers have contributed freely of their time to help these meetings. The State has been divided into districts, and the people in the various localities organized local farmers' institutes. During 1906 every county in the State had a farmers' institute.

The first county agents under a cooperative agreement between the United States Department of Agriculture and the college of agriculture began work in Cascade, Custer, Gallatin, and Fergus Counties, July 16, 1914. The governor gave his assent to the Smith-Lever Act May 18, 1914, and the legislature accepted the terms of this act on February 18, 1915.

Organization and administration.—The extension department of the State College of Agriculture and Mechanic Arts is organized with a director as its head, who is also dean of agriculture and director of the experiment station. He is responsible to the president of the college. In conducting the extension work the director is assisted by a State county-agent leader, with whom there were associated during the year six county agents. There is also a leader of boys' and girls' clubs and a specialist in each of the following lines of work: Home economics, dairying, live stock, and farm management. There are eight persons who have given full time to

extension work, two have given more than half time, and one less than half time. The specialists are responsible to the subject-matter departments of the college and experiment station, but are administratively responsible to the extension director. Most of the correspondence is addressed to specialists of the subject-matter departments, who reply direct.

Publications and mailing list.—Six bulletins relating to club work and eight publications relating to cooperative home-economics extension were issued during the year. All articles written by county agents are sent to the extension department, where they are edited and are mailed directly to the local papers in the counties in which they originated. If the articles are of State-wide benefit they are sent to other publications. No special mailing list is maintained for extension publications.

The following publications were paid for from Smith-Lever funds: Instruction to Boys and Girls in Club Contests; Cow Testing; and Canning Instructions for Girls' Club Contests.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	6,456
United States Department of Agriculture, Bureau of Animal Industry	1,334
State appropriation	4,200
College of agriculture	5,384
County appropriation	2,308
Total	29,682

Smith-Lever funds were used in conducting the work under the following projects: County agents, home economics, boys' and girls' clubs, farm-management demonstrations, and live-stock improvement. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, and dairy extension.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 4 county agents, and on June 30, 1915, there were 6. The county agents are supported financially under a cooperative plan by the United States Department of Agriculture, college of agriculture, State appropriation, and a county appropriation which shall not exceed $1,200 a year. Since the counties are so large, it has been found necessary to use local agricultural organizations or to organize such, through which to con-

duct the work of the agent in lieu of one central county organization. Owing to the rapid increase in population which in many cases has been due to the immigration of persons without experience on farms, much of the time of the agent has been given to making advisory calls on the individuals. Early in the year each agent prepared a plan for such demonstrations as in his judgment needed development in his county. The principal ones were corn growing, smut treatment, building of pit silos, planting of alfalfa in rows, the development of the farm garden, and the campaign for the prevention of blackleg. The following items are some of the principal activities: Crop systems planned, 55; drainage systems planned, 4; irrigation systems planned, 9; farms on which seed corn is selected in the fall, 109; silos constructed, 14; farmers growing corn following the suggestion of the agent, 141; farmers growing alfalfa following the suggestions of the agent, 142; and cattle treated for blackleg, 1,824. The county agents assisted the State leader of farm-management demonstrations in the taking of farm-analysis records.

Home economics.—The specialist in home economics gave 132 lectures before women's clubs, farmers' institutes, granges, and high schools, at which there was a total attendance of 11,521. She gave 103 demonstrations at meetings at which the total attendance was 6,888. Short course or extension schools were held in cooperation with local womens' organizations. The local expense was defrayed from money raised by selling membership tickets, at $1 each.

Boys' and girls' clubs.—The State leader of boys' and girls' clubs has organized 119 corn clubs, 119 potato clubs, 29 home-garden clubs, and 175 gardening and canning clubs, with a total membership of 2,689. All of the county agents have cooperated with the leader of this project in organizing her work in the field. During the canning season she conducted 32 canning demonstrations, at which there was a total attendance of 1,206. Club exhibits were made at 28 fairs.

Farm-management demonstrations.—The leader of this project had made 198 farm-analysis records, of which 87 had been returned by letter and 22 in person. A total of 7 meetings were held, at which farm-management problems were discussed. This work is cooperatively handled with the United States Department of Agriculture.

Live stock.—The live-stock specialist spent most of his time during the year lecturing at farmers' meetings and short courses, at which the causes and prevention of live-stock diseases have been discussed. In a few places stock-judging classes have been conducted, at which both the living animal and lantern slides were used to illustrate animal types. One hundred and twenty-nine lectures have been given to a total attendance of 11,550 people. Lectures and demonstrations were delivered at the three and four day short courses held at Kalis-

pell, Hamilton, Ekalaka, and Sidney. A home-remedy poster containing directions for the prevention and treatment of live-stock diseases was presented to the members of the live-stock classes. An increasing amount of time of the live-stock specialist has been given to cooperating with county agents in conferences, demonstrations, and addresses in the promotion of live-stock interest.

OTHER EXTENSION WORK.

One hundred and forty-four farmers' institutes were conducted under the auspices of the extension department; 44 different lectures were given to 1,893 people; 14 persons from the extension staff and 27 other persons took part in these institutes. A special State appropriation of $10,000 was made for their support.

Dairy extension.—The dairy specialist devoted most of his time to interesting farmers in building silos, in order that a cheap and palatable winter feed may be at hand. As a result of this work 11 silos were built during the summer of 1914. Corn, alfalfa, clover, peas, and oats were used to fill most of them. The experiment station has furnished a bushel of each of seven varieties of silage corn, which has been planted on 25 different farms for variety tests. Some interest in growing corn for silage has been aroused through the boys' and girls' clubs, and as a result 20 boys have joined the corn club. One man who built a silo was able to buy some young stock cheap, because he had extra feed, while his neighbor was short of feed to carry them through the winter. Another farmer was able to make good silage from clover that could not be cured for hay. One man, who assisted the leader of this project, has induced dairy farmers to keep records of 37 herds, in which there are 310 cows. Milk-testing demonstrations have been given in 5 county schools. Eleven miscellaneous meetings were attended, at which dairy subjects were discussed. Twelve special dairy institutes were also conducted. The State leader of farm-management demonstrations was assisted in taking records of 65 farms. From November 9 to March 12, the afternoons were spent in teaching in the farm boys' short course at the Flathead County High School, 17 boys being enrolled. Breeds of dairy cattle, stock judging, milk testing, and other subjects that pertain to the dairy industry were discussed.

OUTLOOK.

The work done by the six county agents has been principally of an advisory nature, especially to those having little or no experience at farming. Definite results of their efforts show that dairying has been given particular attention, especially as to silo building, cow testing, and the prevention of blackleg. A more liberal appropria-

tion by the counties for the support of the agent would be conducive to the permanency of this work. When it is realized that some counties in which agents are working are larger than some States in which 10 or more agents are employed and that transportation facilities are far from adequate, it will be seen that the work is being done under difficulties.

The extension work of the State seems to be well organized with a good esprit de corps among the workers.

NEBRASKA.

Division of Agricultural Extension Service, College of Agriculture, University of Nebraska, *Lincoln.*

C. W. Pugsley, *Director.*

History.—Records indicate that the first Nebraska farmers' institutes were held in 1877, that the first institute organization was formed in 1882, and that this organization was still active in 1906. Other organizations followed. In 1889 the first three-day farmers' institute was held in Custer County.

Legislative appropriation was first made for farmers' institutes in 1897, when $3,000 was raised for the biennium. This fund was increased to $8,000 in 1901, and to $12,000 in 1903. In the season of 1903–4, 43 one-day and 49 two-day institutes were held, totaling 330 sessions, with an attendance of 26,000. In 1914–15, 178 institutes were held totaling 602 sesions, attendance 79,245, with an estimated expenditure of $22,000. The institute fund is now drawn from the general fund of the State, but is under control of university regents.

Practically all extension work was farmers' institutes till 1906, when extension schools and boys' and girls' club work were established.

The assent of the governor to the terms of the Smith-Lever Act was given previous to May 23, 1914. The State legislature accepted the act on April 5, 1915.

Organization and administration.—The extension work in the University of Nebraska was organized as an extension department coordinate with the experiment station of the college of agriculture in September, 1911, with a director at the head. The extension work is governed by an extension council composed of the dean of the college and the heads of the subject-matter department. This council meets on call to consider the extension projects. The director reports to the dean of the college. The extension department is organized into divisions of county-agent work, boys' and girls' club work, publicity, fair exhibits, correspondence courses, specialists, and home-economics and women's club work. The correspondence

courses, specialists, and home-economics work are administratively directed by the director of extension, but the heads of the subject-matter departments of the college are responsible for the subject matter taught by the extension specialists. The extension specialists have offices with the subject-matter department, but are administratively responsible to the director of extension.

Thirty-four persons gave full time to the extension work during the year, 1 person more than half time, and 10 persons less than half time. Members of the extension force hold the same relation to the college of agriculture as members of the resident teaching faculty hold, with the same rank, and in many instances, the same title.

Publications and mailing list.—No publications were printed on Smith-Lever funds, but the second annual report of the county-agent work and three miscellaneous bulletins were distributed in the furtherance of extension work.

No separate mailing list is maintained. The experiment-station list is being used, though it is rare that an extension publication is sent to the entire list of 30,000 names. The experiment department provides for a mailing clerk, and the disposition of mail is quite well organized. The department issues the Extension News Service weekly, which reaches about 85 per cent of the papers published in the State.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	14,081
United States Department of Agriculture, Bureau of Animal Industry	2,794
State appropriation	25,000
Counties	5,000
Other sources within the State	20,000
Total	76,875

The following projects were partially supported by Smith-Lever funds: Administration, county agents, home economics, and specialists in agriculture. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, and pig clubs.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—County-agent work began in Merrick County in 1913. Five agents were at work at the beginning of the fiscal year

1914–15, and eight at the close of the year. County-agent work is financed by funds direct from the United States Department of Agriculture, college, and local funds from county farm-bureau associations. During the year the county agents made 4,586 farm visits, and 5,899 people called on them on business. The agents addressed 587 meetings with a total attendance of 24,430; assisted in organizing 8 associations for developing live-stock interests and 4 farmers' exchanges; organized 24 boys' and girls' clubs with a membership of 562. These agents visited 219 public schools and assisted the development of agricultural instruction in 127 of them.

The work done in relation to the farm included: Planning and improving 41 farm buildings, construction of 19 silos, improvement or installation of 17 water-supply systems, improvement of sanitary conditions on 70 farms, planning 17 drainage systems draining 1,430 acres, and planning 4 irrigation system to irrigate 360 acres.

The work with farm crops included a total of 78,063 acres on 4,053 farms which were planted on suggestions made by the agents, 13,300 acres planted with selected seed corn on 1,110 farms, 7,400 acres planted with tested seed corn on 317 farms, 1,140 acres sown to wheat on 26 farms, 42,240 acres sown with treated oat seed on 2,005 farms, 6,230 acres of oats on 120 farms grown on suggestions furnished, and 438 farms used treated potato seed.

Agents' suggestions were followed on 85 farms in growing 250 acres of potatoes, 160 acres of hay on 6 farms, 1,755 acres alfalfa on 89 farms, 388 acres sweet clover on 36 farms, 150 acres barley on 4 farms, 230 acres rye on 14 farms, and suggestions were followed in the handling of 58 orchards.

With live stock, on the agents' suggestions, 281 registered breeding animals were secured, 289 animals not registered were purchased, and 20,928 animals tested or treated for disease.

Thirty-eight thousand dollars worth of business was transacted by farmers' exchanges organized by county agents in 1915 and $21,000 worth was done by exchanges organized prior to 1915, totaling for the year $69,000, making a direct saving to the people of $4,000 in this one part of the agents' work alone.

Extension specialists.—The work of the specialists consisted in giving assistance through the county agents.

The dairy work in cooperation with the United States Department of Agriculture, Dairy Division, resulted in arousing a general dairy interest in the State. Among other work the representative organized three cow-testing associations, assisted in the improvement of numerous milk-supply centers, conducted milk-testing and judging demonstrations, and addressed 146 meetings.

The work in agricultural engineering is noted in the results obtained by county agents in silo and farm-building construction, installation of water supply, drainage, and irrigation systems.

Other work consisted of installing 17 water-supply systems, 3 lighting systems, and 1 heating system; also many blue prints of farm buildings were made.

Home economics.—One woman gives full time and another part time to work in home economics, the chief projects being movable schools and work with various women's clubs in the State. In the former, instruction is given in the form of lectures illustrated by charts. For the clubs courses of study have been planned, textbooks and bulletins recommended.

OTHER EXTENSION WORK.

By legislative provision farmers' institutes are handled through the extension division. About $10,000 of State money and $12,000 raised locally were used for institutes during the year in holding 178 institutes covering 111 days; 602 sessions were held, with a total attendance of 79,245. The number of lecturers was 54, 13 being members of the extension staff and 41 coming from outside. These institutes included both work with men and women.

Boys' and girls' clubs.—Five thousand eight hundred and eight boys and girls were enrolled in clubs. Of these 2,694 girls were enrolled in garment-making and clothing clubs. In the other clubs 569 actually began work and 462 completed the work. In pig clubs 550 members were enrolled; 132 began the work, and 77 completed the work.

Farm-management demonstrations.—Work in farm-management demonstrations was started rather late in the year; 392 records were taken in 10 counties. The work was done cooperatively with the United States Department of Agriculture.

OUTLOOK.

The extension work of all departments is carried on in close cooperation with the county agents, but without neglect to the extension needs of other portions of the State. Difference in soil and rainfall throughout different portions of the State make the work of the county agents especially valuable in bringing to the farmers that kind of information best fitted to their needs. The extension work of the State seems well organized, and substantial work is being done in all the different lines of endeavor. The boys' and girls' club work is especially strong.

NEVADA.

Division of Agricultural Extension, College of Agriculture, University of Nevada, *Reno.*

C. S. KNIGHT, *Acting Director.*

[C. A. Norcross appointed in July, 1915.]

History.—The first farmers' institute was held at Elko December 13 and 14, 1901, and in 1902–3 three institutes were conducted by members of the experiment-station staff. Encouraged by the experiences of these two years, the station staff planned and held institutes in nine different sections of the State. From the beginning, home economics as well as agricultural subjects have been discussed at the institutes. The development of agriculture and agricultural extension in the southern part of the State has been stimulated because of food supplies required by the miners.

The governor of the State gave his assent to the terms of the Smith-Lever Act prior to June 16, 1914, and the State legislature accepted the terms of the act on February 10, 1915.

Organization and administration.—The extension division is coordinate with the experiment station, with which it cooperates. At its head is an extension director, who is responsible directly to the president of the university. All of the specialists, with the exception of those in dairying and home economics, are also members of the faculty or of the experiment-station staff. The home-economics specialist devotes her entire time to her project, which includes instruction for women and for girls engaged in club work. The dairy specialist is employed cooperatively by the extension division and the United States Department of Agriculture.

Publications and mailing list.—A monthly extension bulletin is issued under the title Better Farming, and is paid for by the State up to an edition of 1,500 copies. The mailing list is composed of the names of about 1,300 farmers and a special list of about 1,000 in girls' club work and home economics. All correspondence is referred to the specialists of the agricultural college and experiment station. Replies to inquiries are usually sent out from the office of the extension director.

Finances.—The following funds have been available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, Bureau of Animal Industry	1,184
Total	11,184

The following projects have been supported in part or wholly by Smith-Lever funds: Home economics, dairying, veterinary science and bacteriology, entomology, and agronomy. The United States Department of Agriculture has cooperated with funds for the support of dairy work.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

Home economics.—The leader under this project organized 5 women's clubs of from 20 to 25 members each, with which she has met from 1 to 5 times during the year and discussed different phases of cooking and home management. She also organized about 50 girls' clubs, having a total membership of 830. Each month these clubs were sent instruction in leaflet form. Fifty-seven conferences relative to home economics have been held at farmers' meetings, parent-teacher associations, and church societies, at which there has been a total attendance of 1,780.

Dairying.—The leader and his assistant have visited 462 farmers and creameries in the furtherance of dairy-extension work. Farmers have been induced to keep herd records and have been advised regarding the feeding and care of animals, the care of milk and cream, and have been given instruction in butter making and in the erection of dairy buildings. One cooperative creamery was organized with 25 farm members. Three sets of plans for dairy barns, three plans for milk houses, and one for a silo have been furnished. One thousand four hundred and sixteen cows were placed under test for butter-fat production, 790 of these were tested through the cow-testing association. There are 14 communities in which herd records are being kept. In two public schools demonstrations have been given in making the Babcock butter-fat test, and a demonstration on dairy sanitation to show the results from the different methods of handling milk.

Veterinary science and bacteriology.—Since January 1, one man has given his entire time to the prevention of animal diseases. This work was under the supervision of the department of animal husbandry at the experiment station. Six public lectures have been given and 176 personal visits to ranchmen were made where demonstrations were often undertaken. Twenty-one herds having a total of 699 dairy animals have been tested for tuberculosis, 295 horses were tested for glanders, 17 of which reacted and were killed, and 1,866 animals have been vaccinated for anthrax. Blackleg, contagious abortion in cattle, and hog cholera have also been treated.

Entomology.—The specialist in charge of this project has given demonstrations in the control of green aphis on cabbage by using a tobacco-extract solution, the control of the spiny-elm caterpillar, and of thrips on truck crops and alfalfa. The tobacco-extract solution was

used on the truck crops, but since such a treatment would be impracticable for large alfalfa fields, farmers were advised to cut the affected alfalfa for hay. Demonstrations were given in the use of arsenate of lead and Paris green to control the pear slug which attacks both pear and cherry trees. He is encouraging the keeping of bees especially by those who are growing alfalfa for seed. His services are in demand in the prevention of foul brood.

Agronomy.—The agronomy specialist has held meetings with farmers in about 20 sections of the State at which he has discussed the value of clean seed and the relation of tillage practices and irrigation to crop production. He has also visited the farmers personally to advise them as to cultural methods. Recleaned seed was distributed to 23 farmers whose cooperation was secured at Farmers' Week held at the college.

OTHER EXTENSION WORK.

The division of botany and horticulture of the college has given one demonstration on the transplanting, pruning, and grafting of orchard trees. A second demonstration was given on the control of fungus diseases of potatoes by the use of the formalin method of treating seed potatoes. At each of these meetings about 50 farmers attended.

One farmers' institute under the name of Farmers' Week was conducted for three days at the college. Five lectures were given by members of the extension staff, and nine were given by persons outside the institution; the total attendance was 1,100. The State appropriated $100 for conducting this meeting.

OUTLOOK.

Nevada is the only State in the North and West in which the county-agent system has not been introduced, due largely to the limited contiguous farming areas. Plans are under way, however, for establishing the system in the more thickly populated valleys. The extension specialists of the college have done good work out over the State in meeting the problems of ranchmen and farmers in the irrigated districts. The extension division is organized along approved lines.

NEW HAMPSHIRE.

Division of Extension Work, New Hampshire College of Agriculture and Mechanic Arts, *Durham.*

J. C. KENDALL, *Director.*

History.—The work of agricultural extension, or the dissemination of agricultural information among the rural people of New Hampshire, began in 1814, when an agricultural society was organized in

the county of Rockingham. A little later the Cheshire County Agricultural Society was organized, and in 1817 an appropriation of $100 was made by the legislature to each of these two societies. As early as 1820 each county in the State had organized an agricultural society and held fairs and received aid from the State, the amount of the appropriations varying from $100 to $300 to each county. The holding of a fair in each county seems to have been the main feature of the work of these societies. The New Hampshire State Agricultural Society was formed about 1850, its purpose being to improve the agriculture of the State. For 10 years it published reports and held agricultural fairs. In 1870 there was created the State board of agriculture, composed of one member from each of the 10 counties, and this form of organization has continued to the present time. The first farmers' institute conducted by the State board of agriculture was at Concord, November 29 and 30, 1870.

The New Hampshire College of Agriculture and Mechanic Arts was established in 1866, and from the first it has recognized extension work as one of its legitimate functions. Members of the college and the experiment-station staffs have engaged in lecture work in connection with farmers' institutes, grange meetings, agricultural fairs, etc. The first special appropriation to the college for extension work was made by the legislature in 1911, when $2,500 was appropriated annually for two years. This amount, though small, made possible the organization work, and the director of the experiment station was appointed director of extension work on April 8, 1911. No part of this money was used for salaries, but it was all used in payment for some form of demonstration work, the supervision of the work being in charge of college and station men. Reading courses were organized, extension publications issued, dairy, orchard, and pasture demonstrations developed, and the foundation laid for the larger work to be developed later.

The assent of the governor to the terms of the Smith-Lever Act was given on June 20, 1914. The State legislature adopted the provisions of the Smith-Lever Act by the passage of an act which was approved by the governor on March 17, 1915. By the terms of this act the State College of Agriculture and Mechanic Arts, at Durham, was designated as the institution to administer the funds. A general memorandum of understanding relating to cooperative extension work in New Hampshire was signed by the president of the college July 24, 1914, and by the Acting Secretary of Agriculture on August 3, 1914.

Organization and administration.—The extension division is organized as a separate department of the college with a staff of workers, most of whom devote their entire time to extension work. The extension director is also director of the agricultural experiment

station and is in charge of all extension activities of the college. The county-agent plan is recognized as being a fundamental part of the extension organization in the State.

Specialists are employed, with headquarters at the college, to conduct definite forms of demonstration work and to assist the county agents. All extension activities or demonstration work conducted in a county where an agent is located is done only after an understanding with the agent and the farmers' county association regarding the same, and with their approval and cooperation. All specialists are selected by the extension director, with the approval of the heads of the various departments. Their headquarters is in the office of the extension director and they are administratively responsible to him. The subject matter taught must first receive the approval of the heads of the subject-matter departments concerned in the experiment station. Eleven men devoted full time to extension work, and one man was employed giving one-third of his time to the work. Members of the extension staff have not been made members of the college faculty and have been given no title or rank comparable with the title and rank of members of the college and station staff.

Publications and mailing list.—The extension publications are of three general types: Press bulletins, circulars, and extension bulletins. The press bulletin, a single page of two columns, is prepared for the use of the daily and weekly papers of the State. These bulletins are also sent to the names on the general mailing list, about 11,000. They are made brief and timely, and deal with subjects that are of immediate importance. Seventeen numbers were issued during the year. The extension circular was a 4-page publication calling attention to the opportunities of New Hampshire farming, especially in relation to the growth of field beans. Two extension bulletins have been published, one of 40 pages and one of 32 pages, the first one dealing with the subject of the marketing of white pine, and the other on cow-testing association work. A publicity department is maintained which collects news relating to extension activities and sends it out to the papers of the State each week in the form of a news letter. All manuscripts presented for publication are reviewed by the heads of the subject-matter departments concerned.

Finances.—The amounts and sources of funds available for cooperative extension work in agriculture and home economics during the fiscal year 1914–15 were as follows:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	3,124
United States Department of Agriculture, Bureau of Animal Industry	90
College appropriation	2,000

State appropriation for poultry extension	$300
Counties from taxation	3,500
Counties from membership fees	1,228
Counties from subscriptions	785
Other funds	10,000
Total	31,027

The following projects were partially supported by Smith-Lever funds: Administration, county agents, home economics, cow-testing associations, orchard demonstrations, extension schools, and demonstrations in vegetable gardening. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, farm-management demonstrations, and cow-testing and dairy farming. A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—The county-agent leader is cooperatively employed by the United States Department of Agriculture and New Hampshire College, each contributing one-half toward his salary and expenses. At the beginning of the year 1914–15 one county agent was employed. At the close of the year five counties were well organized, with agents employed, and the work of the county agent was well established in the State.

No effort has been made to stimulate the organization of counties for this work, but information was given where interest was shown, and the growth has been a normal, healthy one. Before an agent is put into any county there must be a well-organized movement of the farmers in support of the work. While business men have given assistance, yet it has been distinctly a farmers' movement in each locality within the county represented in the county organization.

The work of the county agents has been placed on a definite project basis upon which the agents are required to render reports. In Merrimack County, of the 27 towns, 15 are definitely organized for cooperation in support of the county-agent work, with from 10 to 47 members in each organization. Cheshire County has an organization of 500 members with directors in 23 towns. The directors share the responsibility for the success or failure of the work.

All the county agents have been given systematic training in the making of farm analyses in connection with farm-management demonstrations. Some 270 actual field demonstrations have been conducted during the year by the county agents. Of these demonstrations, 71 related to varieties of ensilage corn, 41 to the use of lime, 41 in relation to alfalfa, 33 in relation to the use of fertilizers, 22 spraying for the control of plant diseases, 16 in relation to the destruction of grasshoppers, 15 pruning of orchards, 7 annual legumes, and miscellaneous 24.

Local directors of the county association introduce the county agents to farmers, arrange for speaking dates in the different localities, secure new membership and renewals, organize farmers' clubs in communities where needed, and take charge of such local buying and selling enterprises as may seem desirable. At the monthly meeting of associations during the year there has been an average attendance of 50. Directors from well-organized towns have rendered valuable service in unorganized towns by introducing and initiating the work and promoting organization.

Home economics.—This work, organized in January, 1915, has been largely associated with movable schools and has resulted in the organization of 14 women's clubs with a membership of 398. The smallest club had 12 members, the largest 61 members, the average membership being 28. The object of the club is primarily to instruct the members regarding labor-saving devices in the home and how these devices may be utilized. Other clubs are in process of organization, waiting only for the help of the demonstrator. The work has already grown beyond the possibility of one woman to care for it. Definite courses of study have been taken up by each club, and in connection with the study definite lectures and demonstrations are given. Eighteen canning demonstrations were given during the year, and 23 lectures delivered at various meetings. The home-economics club plan seems to be firmly and successfully established in the State.

Cow-testing associations.—Dairy farming is conducted on 75 per cent of the farms of the State, and the low-producing dairy cow has been one of the chief factors in keeping down the labor income. To remedy this condition and bring the farmer actual information as to the value of individual cows, the cow-testing association has been developed. Ten associations are in successful operation, with a membership of 300 farmers and with 4,500 cows under test. As a result of this work, the poor cows are being weeded out each year, and farmers through their associations are learning to work cooperatively in other lines and are studying problems of feeding and dairy management in such a way as to bring definite results.

Orchard demonstrations.—Work under this project began in January, 1915, and during the spring 30 pruning and spraying demonstrations were held, reaching approximately 900 persons. Seven permanent demonstration orchards have been secured, and these orchards will serve as meeting places where instruction will be given in orchard management. Demonstrations are given showing the value of the sod mulch in an uncultivated orchard, the use of cover crops, and the importance of thinning in the renovation of neglected orchards.

Extension schools.—During the year 13 extension schools were held with 98 sessions, a total attendance of 3,417, and an average attend-

ance at each session of 35. Each school continued for four days, with lectures in the forenoon and afternoon of each day and during two evenings. These schools have been located in the sparsely settled communities, and while this has resulted in lessening the attendance it has brought the work directly to the farmers and their families. All lectures and demonstrations given at these schools have first been reviewed by the college and station departments and the subject matter approved. Summaries of each lecture were prepared and distributed to those in attendance. The work has been done in cooperation with the county agents and has served to increase the membership in the county associations, in some cases doubling it, and has made possible the introduction of various extension activities. The lines of work most emphasized have been in connection with home economics, soils, crops, and dairying.

Vegetable-garden demonstrations.—It was found that in a number of towns in New Hampshire from 70 to 85 per cent of all the vegetables used were imported. Vegetable-garden demonstrations were conducted with the farmers in those towns containing the largest centers of population, and efforts were made to encourage the growth of vegetables and small fruits and to secure correct methods in marketing the same. Some 20 demonstrations were conducted during the year, these demonstrations consisting of work with potatoes, peas, strawberries, raspberries, sweet corn, and squashes.

OTHER EXTENSION WORK.

During the year $10,000 was received from sources outside the State for the purpose of conducting extension work in the State. This resulted in dairy-farm demonstrations being conducted in Grafton County, 18 dairy demonstrations and 56 field tests being made. As a result of the demonstrations in top-dressing of hay lands the increase in yield was from one-half ton to 2.3 tons per acre. Orchard demonstrations were conducted in Hillsboro County in cooperation with fruit growers in 14 towns. Several field meetings were held in these demonstration orchards, with the attendance at some as high as 150. Local organizations for marketing fruit and for purchasing supplies have been developed. Soil-fertility demonstrations were conducted in Rockingham County, 32 demonstrations during the season, the purpose of each being to teach some lesson in soil improvement. Boys' club work resulted in a membership of 600 boys, each of whom did some definite work and reported upon the same. Club members raised as high as 90 bushels of air-dried corn and 400 bushels of potatoes to the acre. This line of extension work promises to rank in importance with any of the activities of the extension service. In

the girls' club work 300 girls were enrolled. The work centered along lines of canning vegetables and fruit and in exhibiting canned goods at various fairs and other places in the State. Nine agricultural reading courses are being conducted, with a total enrollment of 300. Exhibits have been made at various fairs in the State. Members of the extension, college, and station staffs have given lectures and demonstrations of various kinds. An "orchard day" has been held in the college in cooperation with the State Agricultural Society. Assistance has been given to the commissioner of agriculture in holding farmers' institutes and special meetings of interest to farmers. Speakers have been furnished at the annual meeting of the State Dairymen's Association, State Potato Growers' Association, Sheep Breeders' Association, and Federation of Women's Clubs, and the closest cooperation has been maintained with the grange of the State.

The State department of agriculture is responsible for conducting the farmers' institutes in the State. This work is in charge of the commissioner of agriculture, and the law creating the office states: "He shall cooperate, as far as may be practicable, with the extension work of the New Hampshire College of Agriculture and the Mechanic Arts." Farmers' institutes have been held in cooperation with the county agents and with the county farmers' associations. The State department of public instruction, through the commissioner of education and his deputies, carry out definite lines of industrial work in the public schools. No formal plan of cooperation has yet been arranged between the agricultural college and the department of public instruction. The State Dairymen's Association holds an annual convention, at which assistance is given by members of the college, experiment station, and extension staff.

Farm-management demonstrations.—Work under this project is done through direct cooperation between the States Relations Service and the State college. The State leader in this project has divided his time between work in New Hampshire and Vermont, giving about half of his time to the work in each State. During the year 377 farm records were taken in New Hampshire and 172 records returned to the farmers; 17 men have assisted in the work, including the county agents; 108 farmers have agreed to keep record books for their work for another year. Eight local meetings were held in the communities where records were taken, with an attendance of 360 farmers, largely those whose records had been taken.

OUTLOOK.

The extension work is organized along practical lines and lines which seem to meet the real needs of New Hampshire agriculture.

A spirit of cooperation seems to prevail between the various departments of college, station, and extension staffs. The county-agent work is established on a sound basis and is making substantial growth from year to year.

NEW JERSEY.

The Extension Division of the New Jersey Agricultural College Experiment Station, *New Brunswick.*

ALVA AGEE, *Director.*

History.—Farmers' institutes have been handled by the New Jersey board of agriculture, which was organized by a law enacted in 172. The college of agriculture, which is a department of Rutgers College, has assisted in these institutes by furnishing speakers. Prior to December 1, 1912, the various departments of the experiment station had engaged in a large amount of practical demonstration, and Mercer and Sussex Counties had been organized for demonstration work.

Through these methods of work the foundation was laid for the organization of the extension division which was created within the New Jersey State Experiment Station and still continues as a department of the experiment station.

The assent of the governor to the terms of the Smith-Lever Act was given previous to May 19, 1914, and the legislature accepted the provisions on April 6, 1915.

Organization and administration.—All extension workers are appointed by the director of agricultural extension, but these appointments are made only after conference with the head of the department of teaching or research involved. All workers are responsible for subject matter to the head of the department with which they are associated, but all are administratively responsible to the director of extension.

The staff is composed of the director, assistant county-agent leader, specialists, assistants, and county agents, totaling 17 giving full time to the work and 12 giving less than half time. With the exception of the director, members of the extension staff are not members of the college faculty.

Publications, mailing list, and correspondence.—Seven publications were issued during the year, including a report of extension work, two home-economics bulletins, three bulletins on marketing, and one on the vegetable garden. The regular experiment-station mailing list, consisting of 10,500 names, is used. Correspondence is handled by the mailing clerk, who sends letters to the departments of instruction or research best qualified to answer them.

Finances.—Data furnished indicate that the following funds were available July 1, 1914, for cooperative extension work during 1914–15:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	4,959
United States Department of Agriculture, Bureau of Anmal Industry	200
State funds	15,666
County funds	10,000
Other organization funds	1,000
Total	41,825

The following projects were partially supported by Federal Smith-Lever funds: Administration, county agents, home economics, club work, and extension specialties. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, and dairy extension.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—Seven counties were organized and financed with funds from local, county, State, United States Department of Agriculture, and Smith-Lever sources. The county-agent work is well received by the farmers, and all other extension activities are closely associated with this project. Work of specialists carrying other projects is done in organized counties through cooperation with county agents, and in some instances is carried along by the county agent to save time and expense. Widely increased areas of legumes, marked improvement in handling of tree fruits and small fruits, better handling of dairies, a distinct saving in fertilization through intelligent mixing of fertilizers, the adoption of more rational methods of housing and feeding poultry, and greater success in control of insect and fungus foes were among the results.

The work of the county agents included 5,998 farm visits and 2,304 calls received their offices on county-agent business. Three hundred and forty-three meetings were addressed, with a total attendance of 16,181. Nine hundred and thirty-two agricultural articles, written by the county agents, were published in local papers. Five short course or extension schools were assisted by the agents, with a total enrollment of 310. Seventy public schools were visited, and in 25 of these assistance was given in developing agricultural instruction.

Seventeen farm buildings were planned or improved, 21 silos constructed, 38 crop-rotation systems planned, 7 drainage systems including 376 acres were devised, and 31 irrigation systems. On 34 farms agents' suggestions were followed in clearing the land.

Twenty-nine farmers selected seed corn in the fall, planting 100 acres with this corn. Suggestions of the county agents were used on 28 farms in growing potatoes, on 63 farms for growing hay, on 123 farms for growing alfalfa, and 21 for cowpeas.

Ten registered male animals were secured on the advice of the county agents. One cow-testing association was organized, testing the profitableness of 900 cows. On 104 farms balanced rations figured by the agents are known to have been adopted. One thousand one hundred and four animals were tested or treated for diseases. One hundred and twenty-five farmers used chemical fertilizers on the advice offered by the agents. Five hundred and twenty-four acres of crops were plowed under for green manure.

Twenty-eight thousand dollars worth of business was done in 1915 by associations organized at the suggestion of the county agents, resulting in a saving of $5,800 to the members.

Home economics.—The chief work in home economics has been the organization in rural communities of home-economics associations for women and canning clubs for girls. About 9,000 people have shown interest in the work of the specialist in home economics and her assistant, who has charge of girls' club work. One hundred and twenty-two canning demonstrations were given, and the specialist believes that 4,000 homes have adopted some of the suggestions and methods. Thirty-six garden and canning clubs have been organized with a membership of 575. Six home-economics associations have been organized, with a membership of 190.

Girls' clubs.—Twenty-five clubs were organized with a total enrollment of 419. All of these clubs actually began work, and 102 members completed the work. The club leader and her assistant gave 176 canning demonstrations, with a total attendance of 14,491; 112 field meetings were held; 20 club members visited; 12 exhibits made at fairs; and 5 club exhibits held.

Specialists.—The specialist in agronomy has conducted work of top-dressing grass lands, carrying on corn-variety demonstrations and soy-bean demonstrations, and has cooperated with 205 men in alfalfa demonstrations. This work has been done partly through county demonstrators and partly through individuals in unorganized counties. The number of farms assisting in all agronomy demonstration work and those adopting the suggestions of the specialist probably total 400.

The work of the specialist in fruit growing has consisted mainly of orchard demonstrations, both in respect to long-term management and in pruning and spraying, and packing and marketing.

The specialist in market gardening began work January 1, 1915. He has conducted demonstrations in spraying of tomatoes, proper

cultural methods for sweet corn, and improved cultural methods for various vegetables.

The specialist in poultry husbandry has given 21 demonstrations in the handling of poultry and poultry production, and has delivered 110 lectures to 10,800 people during the year. The chief projects are the management of layers, incubators, brooders, and growing stock.

The extension work in dairy husbandry has not been pushed on account of lack of funds. Oversight has been given to 3 cow-testing associations.

OTHER EXTENSION WORK.

The members of the extension staff delivered lectures at farmers' institutes, and in organized counties the county agents conducted the institutes for the State board of agriculture.

OUTLOOK.

The county-agent and home-economics work seem to represent especially the strong features of the year's work. The extension work seems well organized and in good favor with the farmers of the State.

NEW MEXICO.

Division of Extension, New Mexico College of Agriculture and Mechanic Arts, *State College.*

A. C. Cooley, *Director.*

History.—Farmers' institutes were begun in 1896 and continued in 1897, but no more institutes were held until 1903, when six institutes were held. Three institutes were held in 1904, and a very limited number have been held since that time. There is no State appropriation for institute work and no State department of agriculture in New Mexico. The agricultural college and the experiment station have been the prime movers in institute work and have furnished many of the speakers, paying expenses out of college funds.

Thus it will be seen that early extension work in the State was conducted by the college, and its continuance is due to its efforts. During 1907 to 1909 the college had one man spending considerable time endeavoring to perfect county farmers' institute societies, but insufficient funds made it necessary to discontinue this work at the end of 1909.

The first Farmers' Week was held at the college in 1911, and since then has been an annual affair, though Farmers' Days had been held prior to this. In 1911 a superintendent of extension was appointed, but lack of funds confined his work chiefly to teaching in the college,

answering correspondence, and giving lectures to county teachers' institutes during the summer. In 1912–13 he did some boys' and girls' club work.

The governor gave his assent to the Smith-Lever Act on May 25, 1914, and the legislature accepted the terms of the act on March 9, 1915.

Organization and administration.—The extension division as reorganized in 1914 is a division of the college coordinate with the teaching and investigational sections. The director reports to the president of the college, who reports to the board of regents. The organization consists of a director of extension, who is also county-agent leader; a secretary and editor; State leader in boys' and girls' club work, in home economics, and in dairying; and seven county agents. Six specialists connected with the college and station give part time to extension work.

Each State agent is in charge of the branch which his title indicates and reports immediately to the director. All State-wide projects are coordinate with the work with county agents.

Publications, mailing list, and correspondence.—Two bulletins—Boys' and Girls' Club Work, and Facts About Silos in New Mexico—and 24 editions of the extension press service sheet were printed with Smith-Lever funds and distributed in furtherance of extension work.

Correspondence is largely conducted by the station and college specialists employed part time on extension work.

The extension division and the experiment station use the same mailing list, which is revised to date and includes the names of the majority of the leading farmers in the State.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	6,833
United States Department of Agriculture, Bureau of Animal Industry	479
College appropriation	604
County appropriation	539
Total	18,455

The following projects were partially supported by Smith-Lever funds: Administration, county-agent work, boys' and girls' club work, home economics, and agricultural specialists. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: Boys' and girls' clubs, county agents, and dairy extension.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—County-agent work was carried on in 8 counties, organized in 7 groups, on funds from county, Smith-Lever, and United States Department of Agriculture, States Relations Service, sources.

The county-agent work presented some difficult problems at its start, first, because of the limited number of farmers' institutes which had been held in the State during the previous years; second, owing to the sparseness of the population in the State; third, because many of the people on the farms and ranches have been there for only a comparatively short time; and fourth, on account of the fact that many of the people do not speak or read English. As a result, much of the time was necessarily spent in making a general survey. A large part of the total work consisted of personal visits and advice. However, the time spent this way resulted in a rather definite knowledge of conditions, and work for the year 1915–16 is already organized on a definite project basis.

The following things among others were accomplished at the suggestion of the county agent: Two thousand one hundred and sixteen different farmers were visited in 4,902 calls, and 2,889 people called on the agent on county-agent business; 12 associations of adults were organized, including cow testing, purchasing and marketing, and live-stock breeders. Seed corn was fall selected on 52 farms. Seed corn was tested for germination on 28 farms, and corn was grown on 54 farms, resulting in an average increased yield of 12 bushels per acre on 830 acres. Wheat grown on 3,465 acres on 90 farms resulted in an average increased yield of 12 bushels per acre.

Oats seed was treated for smut prevention on 3,710 acres on 182 farms. Oats were grown on 1,410 acres on 44 farms, resulting in an increased yield of 16 bushels per acre.

Twenty-three farmers grew 950 acres of alfalfa; 1,278 acres were inoculated for alfalfa on 34 farms; 122 acres of sweet clover were grown on 9 farms; 34 farmers grew barley and rye on 641 acres on plans furnished; and 4 orchards were planted and 62 orchards cared for in whole or in part.

One hundred and seventy-six registered breeding animals were secured and 1,020 other animals purchased. One cow-testing association was organized, which provided means for testing the economic production of 124 cows, while 215 cows were similarly tested by farmers outside of these associations; 23 farmers used balanced rations furnished, and 4,884 animals were examined or treated for disease.

One hundred acres of hay was top-dressed; 107 farm-analysis records were taken; 10 farm businesses reorganized, and 17 farmers were induced to keep farm accounts; and $56,000 worth of business was done in 1915 by associations organized, making a direct saving of approximately $3,600 to the farmers. One hundred and twenty-five dollars was saved by reduced shipping rates.

Home economics.—Work in home economics consisted first in visitation or investigation to learn the conditions under which the people were actually living, their needs, and opportunities. Numerous meetings have been held on the round-table discussion plan, which have proved very successful in opening a way to learning the conditions and starting permanent and follow-up work. Articles on home-economic subjects have been printed in several of the extension press-service sheets, and one bulletin has been written. Demonstrations in various phases of home economics found a good reception, and a spirit of interest is beginning to manifest itself. As far as possible this work has been carried out in cooperation with the county agents and as a part of their problem of farm and ranch development through home influences.

The following statistical summary covers a portion of the work of the State leader in home economics: Sixty farm homes visited; total number of meetings held, 460, with total attendance of 6,960; women's organizations formed, 32; number of organizations formed, 15, with total membership of 300; movable schools and short courses held, 21; 102 demonstrations given; number of counties served, 18.

Boys' and girls' clubs.—Club work began December 1, 1914, and is supplementary to the teaching of agriculture and home economics in the public schools; as a result the work is propagated through the schools largely. The active cooperation of the State department of education, county superintendents, and teachers has been secured. At the beginning of the work it seemed to be necessary to allow the boys and girls to handle numerous different projects in the same club, but in the future a special effort will be made to have each club handle only a limited number of projects. Eight hundred and seventy-four boys and girls were enrolled, as follows: Field crops, 144; potatoes, 2; garden and canning, 111; poultry, 150; pig clubs, 66; bread making, 193; sewing, 210. At least a third of these members actually began work, so that in all probably over 200 families were reached.

Agricultural specialists (employed part time).—The principal duties of the part-time specialists are answering inquiries from farmers. They have also made occasional trips to assist county agents in solving problems and conducting short courses. Trips to the number of 25 have been made, 31 articles prepared for the press service, 8 press bulletins written, and 2,000 farmers' inquiries answered by these men.

OTHER EXTENSION WORK.

Dairy work.—The dairy work has been handled in conjunction with the county agents. In one county farmers have been induced to go extensively into dairying and imported 700 cows during one summer and fall. A strong organization was effected, and the men are finding a ready market, which brings them in nearly $100 a day for milk and cream. Two creameries have been organized, and the organization of another was prevented because circumstances would not have allowed its financial success. Four breeders of registered dairy stock were induced to send a carload of show stock to the State fair. From this lot five persons in another section purchased animals, two of these purchasers never having owned any registered animals and the other three never having owned any registered females.

OUTLOOK.

The limited amount of extension work done in former years, the sparseness of population, the presence of people who neither read nor speak English, present difficulties which require much attention in organizing and developing extension work.

The survey and personal-advice work this year has opened the way for steady, though necessarily slow, progress. The extension division seems compact, well organized, and efficiently directed.

NEW YORK.

Division of Extension, New York State College of Agriculture, *Ithaca.*

B. T. Galloway, *Director.*

History.—The farmers' institutes in New York grew out of the old farmers' clubs, many of which were organized over 100 years ago. For many years speakers were furnished by the State Agricultural Society. Since the establishment of the agricultural college in 1868 and the agricultural experiment station at Geneva two years later speakers have been furnished by both institutions. The present institute system was organized in 1885, and the first meeting was held at Ithaca in 1886. The State Agricultural Society arranged to have three institutes, and $1,050 was appropriated from the funds of the society for this purpose. During the session of the legislature in 1887, $6,000 was appropriated to hold farmers' institutes in various parts of the State. Gradual increases in appropriations were made until 1898, when $20,000 became available for this work. A director of farmers' institutes was provided for in the law of 1893, and in 1896 a corps of women speakers was organized. The special needs of a community were considered in placing lecturers in order that the specialists in such subjects as bee-

keeping, horticulture, and poultry would be of greatest service. In 1899 "normal institutes" were organized for the purpose of instructing farmers' institute lecturers before they took up the work in the field. In 1894 a law was enacted providing a fund for the Cornell Experiment Station to conduct extension work and to promote horticultural interests in western New York. As a means of carrying out one provision of this law the first horticultural extension school was held near Fredonia in 1894. In 1896 there was developed a plan to help rural school-teachers by furnishing them leaflets and by assisting them to organize junior naturalist clubs. Some years as many as 30,000 children carried on correspondence work with Cornell University through these clubs. In 1897 an appropriation of $25,000 enabled the college of agriculture to carry on instruction by means of lectures, cooperative experiments, farm advisers, and reading courses. The appropriations for this type of work reached a maximum of $75,634 in 1915. The first county agent employed on a cooperative basis, not only in New York but in Northern and Western States, began work in Broome County on March 20, 1911, under a plan in which the United States Department of Agriculture, the State College of Agriculture, the Delaware, Lackawanna & Western Railroad Co., and the Binghamton Chamber of Commerce cooperated.

The governor of the State gave his assent to the Smith-Lever Act June 11, 1914. A resolution passed the State Senate March 31, 1915, which was concurred in by the assembly April 2, 1915, whereby the terms of the Smith-Lever law were accepted.

Organization and administration.—The administrative authority is centered in the office of the dean of the college of agriculture, who is also director of the experiment station and of agricultural extension. Each department of the college has its extension professors, assistant professors, and instructors for the development of subject-matter projects in cooperation with the farm bureaus or independently. They have the same professorial rank as the other members of the subject-matter departments. The department of extension teaching is organized at the college with a professor in charge. This department organizes and administers collective effort such as may be involved in the conduct of extension schools, the organization of reading and study clubs, farmers' week conferences, joint lectures, and exhibits at fairs. Usually the department of extension teaching takes the initiative in organizing collective work, but the dean of the college may group the instructors, using the department of extension teaching as a clearing office. Occasionally lines of extension work connected with the activities of the experiment station of the college are directed by the subject-matter departments. In administering the general extension activities of the college, the department

of extension teaching cooperates with an extension committee representing the several departments in the college. The execution of the plans lies with the separate departments. Cooperative projects with the farm-bureau agents are made operative through the State leader of farm bureaus. The farm bureaus are jointly organized and supported by a local farm-bureau association, the New York State College of Agriculture, the State department of agriculture, and the United States Department of Agriculture. It is the policy of the extension department to encourage the organization of farm-bureau associations only in counties where at least 10 per cent of the active farmers have expressed a willingness to cooperate.

Secondary agricultural schools of the State may participate in extension work in the county in which the school is located, provided they prepare a project for a definite line of work which meets the approval of the related subject-matter department at the college. All extension projects involving work with young people who are enrolled in the public schools, or involving relations with teachers and superintendents throughout the State, are conducted cooperatively between the department involved in the work and the department of rural education in the college. Such projects must receive the approval of the State education department, with which the rural education department cooperates. The head of the rural education department has been made a member of the staff of the State department of education. The total number of persons giving full time to extension work was 30, exclusive of county agents; more than half time 4; less than half time 27.

Publications and mailing list.—During the past year the following extension publications were issued by the college of agriculture; none of them were paid for from Smith-Lever funds: Reading courses for the farmer, reading courses for the farm home, farm-bureau circulars, extension circulars, and rural-school leaflets.

The mailing list is classified under various headings, such as farmers' reading courses, reading courses for farm homes, and rural-school leaflets. Approximately 285,000 names are upon the mailing list for extension publications.

Letters received from the field, unless directed to a particular department, go to the office of the director, who sends them to the departments of instruction involved. When such correspondence comes from a county having an agent, he may be given information as to the nature of the inquiry and be requested to render assistance. Letters coming direct to the department of extension teaching are sent to the department of instruction involved. In case the State leader of farm-bureau managers desires assistance from any department in connection with the farm-bureau work he goes direct to the department from which assistance is desired without making any request

from the director of extension or the head of the department of extension teaching.

Finances.—The following funds were available for cooperative extension work for the fiscal year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative extension work	26,586
State	57,200
College	7,946
County	64,827
Income from miscellaneous sources	7,000
State fund for farm bureaus	19,150
Total	192,709

Smith-Lever funds were used in conducting the work in the following projects: Home economics, extension schools, entomology, farm crops, farm-management demonstrations, pomology, and plant diseases. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, and farm-management demonstrations.

A detailed financial statement has been received and approved.

SMITH-LEVER PROJECTS.

Home economics.—The department of home economics conducted 38 farm-home demonstration schools in 25 counties. The total enrollment was 1,238, an average of 32½ per school. Instruction was given mainly in food values, elementary dietetics, and methods and principles of cooking. Twenty-three of the farm-home demonstration schools were conducted under Smith-Lever funds. On Friday in many of the schools a club or home circle is organized for the purpose of continuing the work in the community after the school is closed. In addition to this work, 1,066 canning demonstrations have been conducted through the agency of the county farm-bureau managers.

Extension schools.—Forty-seven farm-demonstration schools in 26 counties were held during the season. The total enrollment was 1,741, or an average enrollment of 37 per school. In counties having farm bureaus preliminary arrangements are made for the schools through the farm-bureau managers. The managers are also present at the schools to coordinate the work with the county projects and particularly to arrange for follow-up work which is conducted cooperatively by the college experts and the farm-bureau managers. Instruction was given in animal husbandry in 30 schools; in farm crops, 23; in soils, 20; in fruit growing, 18; in poultry, 15; in farm management, 13; in plant pathology, 6; in insect pests, 5; in vege-

table gardening, 5; in farm plumbing, 3; in gas engines, 1; and in agricultural chemistry, 1.

Demonstrations in entomology.—Much of this work was in the nature of consultations after the necessary information for prevention or control was given. The carrying out of the suggestions were left with the farm-bureau managers to help the grower to put the recommendations into practice. In some cases farm demonstrations were arranged through the farm bureau, particularly in the control of certain onion insects and in the dusting of orchards. In cooperation with the department of plant pathology in the college, demonstrations were made showing the comparative value of dusting and spraying in the control of apple insects and diseases. Four applications of dust and spray were made in each of four orchards, and the results were checked up at picking time. An exhibit of injurious insects was shown at three meetings of the State horticultural societies and at agricultural fairs.

Farm crops.—In addition to four months' work in the demonstration schools, the leader of this project has started about 400 cooperative demonstrations with farmers, most of which are follow-up work after the demonstration schools.

Farm management.—The work in farm management was divided into two projects, one of which provided for the maintenance of an extension instructor of farm management, who spent a year in teaching in the demonstration extension schools, at fairs, and in doing other forms of extension work. Records of 115 farms were secured in Broome County on the cost of producing milk. The other provided for demonstrations in farm management, and was conducted in cooperation with farm-bureau managers. The number of farm-analysis records taken by county agents was 1,624; farms which agent knows have been reorganized as a result of farm analysis, 39; farmers induced by agents to keep farm accounts, partial or complete, 263.

Pomology.—The work accomplished under this project during the year follows: Lectures, 16; pruning, spraying, and packing demonstrations, 52; inspections, 17; exhibits at State and county fairs, 5. An apple train was operated through the fruit section of the State for three weeks in cooperation with the New York Central Railroad and the State department of agriculture.

Plant diseases.—Demonstration meetings have been held for the purpose of showing how to control oat and wheat smut, how to treat seed potatoes, prepare Bordeaux spray and dust for apple trees, spray potatoes, dusting for the control of hop mildew, and rogueing potatoes. Thirty lectures have also been given at farmers' institutes, horticultural society meetings, clubs, and granges.

OTHER EXTENSION WORK.

The following lines of work were conducted entirely with State funds:

Four courses were given in extension teaching during the past year to 272 students.

The program for farmers' week is arranged and conducted by the department of extension teaching. During the week there was a total registration of 3,077 persons, representing 58 counties; 269 lectures were given and 26 demonstrations. There were 38 laboratory courses and 16 conventions and conferences.

To assist granges, agricultural societies, and country churches, 479 miscellaneous meetings were held, with an attendance of 52,772.

Exhibits were sent to 18 fairs. The following departments were represented by small exhibits: Poultry husbandry, entomology, pomology, farm crops, vegetable gardening, dairy industry, plant pathology, and ornithology.

Four demonstration cars were run over two different lines of railroad, covering a period of 58 days.

Meetings were held where field demonstrations were made, at which the attendance was 63,672.

In reading courses 12,984 persons enrolled. Twenty-five Cornell study clubs have been organized for the purpose of studying lessons. Advanced reading courses were provided in fruit growing and vegetable gardening for which 121 persons enrolled. For the reading courses in home economics there were enrolled 42,929 persons. The number of clubs organized for the study of home economics by means of bulletins was 122.

In forestry-extension work the leader of this project made examinations of 26 woodlots, at the request of owners, and lectured at granges, farmers' institutes, and extension schools.

The leader of the poultry project gave 319 lectures, 126 demonstrations, 45 educational exhibits, 356 farm visits, and assisted in the selecting of 14,920 breeding fowls.

The leader of the project in soil technology has given advice as to drainage of land on 25 farms. The extension instructor in vegetable gardening conducted a series of demonstrations to show the influence of various fertilizer materials on 11 farms. A meeting was held at each of these farms in order that the growers of the neighborhood might observe the results.

The leader of the home-economics canning clubs has given instruction and demonstrations to children in rural schools. The canned products exhibited at school fairs are judged by the specialists in junior home economics from the college.

County agents.—The organization of the county-agent work consists of a county-agent leader and an assistant county-agent leader employed jointly by the college of agriculture, the State department of agriculture, and the United States Department of Agriculture. There is a farm-bureau association made up of membership representing each county. The control of the organization is in the hands of the farmers and representatives of the farmers known as an executive committee or board of directors, who are consulted with reference to lines of work to be done and as to the employment of an agent. When an agent is to be employed, the county-agent leader recommends to the executive committee two or three men whom he thinks are qualified for the work. The final selection must meet with the approval of the college and the United States Department of Agriculture. The State legislature makes an appropriation of $600 to each county establishing a farm bureau and employing an agent. So far as funds are available, the United States Department of Agriculture contributes toward the salary of each agent. The necessary additional financial support is provided by the farm-bureau organization. Once a county agent is employed it is understood that he shall be the director of extension activities within this county. Twenty-five agents were employed at the beginning of the year and 30 at the close in as many counties.

On suggestions furnished or under the direction of the county agents the following things were accomplished: Farm buildings planned or improved, 80; silos constructed, 35; crop-rotation systems planned, 274; drainage systems planned, 128; farmers given advice in clearing land, 36; farmers selecting seed corn in fall, 218; farms on which corn was grown, 316; farmers treating seed oats for smut, 4,074; farmers planting hill-selected seed potatoes, 350; farms on which seed potatoes were treated for scab, 292; farms on which alfalfa was grown as suggested, 655; seed or soil for alfalfa inoculated on 763 farms; soy beans grown on 158 farms; orchards cared for in whole or in part, 559; inoculations supplied for legumes, 220; registered male animals which agent knows were secured on his suggestion, 108; registered sires transferred from one community to another, 4; cow-testing associations organized, 31; cows tested for milk production, 18,027; farms on which balanced rations figured by the agent are known to have been adopted, 233; farms on which poultry management has been improved, 143; animals treated for blackleg, 65; hogs vaccinated for cholera, 88; farmers given advice in regard to control of poultry diseases, 199; farms on which agent assisted in controlling foot-and-mouth disease, 52; farmers reinforcing manure with acid phosphate or floats, 139; farms using commercial fertilizer, 672; farms on which chemical fertilizers were

home mixed, 379; local sources of lime or limestone developed, 24; limestone crushers or grinders introduced, 10; tons of lime or limestone used, 41,920; acres of hay land top-dressed, 1,471; acres of legumes plowed under for green manure, 464; farmers influenced to conserve manure, 12.

OUTLOOK.

The county-agent work has developed rapidly during the year. Strong farm-bureau organizations have been established, and both the State and the counties have contributed liberally. This is one of the strongest features of extension work in the State and is recognized by extension specialists in planning their work. Relationships have been established so that a very large measure of responsibility and control is exercised by the council and executive committee of the farm bureaus, thus insuring local initiative and responsibility.

NORTH DAKOTA.

Division of Extension Work, North Dakota Agricultural College, *Agricultural College.*

THOMAS P. COOPER, *Director.*

History.—The first farmers' institute was held in 1894, though no appropriation was made until 1902, when $1,500 became available. However, numerous institutes were held, expenses being paid by people where the institute was held, and the travel expenses being met by funds from the college and experiment station. In 1904 $4,000 was available for institute work, which was expended under a governing board composed of the president of the board of trustees of the agricultural college, commissioner of agriculture and labor, director of the experiment station, professor of agriculture, and professor of dairying at the agricultural college. This opened the way for other extension work to be taken up by the college.

North Dakota was one of the first States in the North to use county agents for the improvement of farm business. The Better Farming Association was organized in 1911, beginning work November 15. As prescribed in the articles of incorporation, the work of this association consisted of the "Dissemination of information and instruction in modern scientific methods as applied to agriculture, the promoting of better and more profitable cultivation of the soil, including rotations and diversification of crops, raising of live stock and poultry, and like subjects pertaining to the agriculture of the State."

During the first year work was done in 12 counties, 18 agents were employed, and 2,346 farmers were cooperated with.

The second year the office of Farm Management of the Bureau of Plant Industry, United States Department of Agriculture, cooper-

ated, and five new districts were added. The State legislature of 1913 passed an act giving county commissioners the privilege of levying not to exceed one-half mill tax for purposes of carrying on agricultural-demonstration field work within the county. On January 1, 1914, the supervisor of this county-agent work was made director of the North Dakota Experiment Station and the work transferred to the station.

The governor gave his assent to the Smith-Lever Act prior to June 23, 1914, and the State legislature accepted the terms of the act April 16, 1915.

Organization and administration.—The extension division and research division of the institution are coordinated under a common director, who is responsible to the State board of regents. There is no official relationship between the extension force and the resident teaching force. The extension work as organized covers three rather distinct fields of operation—the county agricultural agent, the general extension specialists, and the general office and informational service. It is expected that the county agricultural agent will be the basis of agricultural-extension activities within the State. Extension specialists are located at the central office and travel throughout the State to assist in various lines as needed.

Mailing list and correspondence.—Mail matter is distributed at the central extension office and is referred to the different research departments concerned and answered by them direct, being sent out under postage.

The only extension publication issued during the year was North Dakota's Farmers' Institute Monthly, issued monthly by the extension department and paid for out of State extension funds. This was sent out as second-class matter to a classified mailing list of about 14,000 names, which list is revised about every three months.

Finances.—The following money was available for cooperative extension work during the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	9,269
United States Department of Agriculture, Bureau of Animal Industry	726
State appropriation	13,942
County appropriation	37,127
Total	71,064

All Smith-Lever funds were spent on county-agent work.

A detailed financial report has been received and approved. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, and dairy extension work.

SMITH-LEVER PROJECTS.

County agents.—At the beginning of the year 1914–15 there were 21 agents working in 16 counties, and at the end of the year there were 22 agents in 18 counties. The work of these agents may be roughly classified into: County advisor and field demonstrations, general advisory work in relation to the farm, and the holding of general meetings, agricultural short courses and schools. Field demonstrations totaling 2,691 were conducted, divided as follows: Rotation plats, 71; hog pastures, 56; alfalfa in plats, 1,003; miscellaneous problems relative to soil and crops, 733; ground-squirrel extermination, 64; demonstrations relative to live stock, 520; miscellaneous demonstrations relative to farmers' organizations, the home, or farmstead, 244. The average yields of the demonstrations with crops when divided into their separate classes show a marked increase over the average yield of adjoining fields and also with a single exception a marked increase above the average yield obtained in the State.

Seven thousand seven hundred and three farmers were visited by the agents in 11,593 visits during the year, and 6,346 farmers called on the agents at their offices in connection with county-agent work. The agents assisted at 1,292 meetings during the year, with a total attendance of 83,046. One hundred and sixty-three associations for adults were organized through the efforts of the county agents, with a total membership of 2,802. These associations include breeders' associations, antihog-cholera clubs, farmers' exchanges, and purchasing and marketing associations. Two hundred and thirty-five days were devoted to 79 short courses at which the total enrollment was 5,088.

Three hundred farm buildings were planned or improved at the suggestion of the agent, and 48 silos constructed. Sanitary conditions were improved on 120 farms, and on 146 farms crop-rotation systems were planned. Four drainage systems were planned, having a drainage area of 320 acres.

Four hundred and sixty-six farmers selected seed corn in the fall, planting 31,090 acres with this selected corn. Acting on suggestions made by the agent, 1,000 farmers grew 19,770 acres of corn, with a resulting increase of 22 bushels per acre; 5,538 acres of wheat were grown by 149 farmers, resulting in an increase of 8 bushels per acre; 39 farmers grew 900 acres of oats, resulting in an increased yield of 8 bushels per acre; 18 farmers handled 371 acres of potatoes, securing an increased yield of 13 bushels per acre; 247 farmers grew 1,189 acres of hay land, resulting in an increased yield of 1¼ tons per acre. On suggestion of the agent, 7,064 acres of alfalfa were planted on 968 farms, and on 72 farms 666 acres of sweet clover were grown. Five thousand three hundred and five acres were inoculated for

alfalfa on 761 farms, 5,139 acres of rye and barley were grown on 144 farms, 17 orchards were planted, and 32 orchards cared for in whole or in part.

Through the efforts of the agent 929 registered animals were secured and 56 registered sires were transferred from one community to another. Two hundred and ten cows were tested for milk production through cow-testing associations organized, and 619 cows were tested by individuals. Two hundred and eighty-four farmers were influenced to feed more live stock, and on 69 farms balanced rations figured by the county agent are known to have been adopted. Three thousand six hundred and ninety-six animals were treated for disease by the agent or on his suggestion, and 194 farmers were given advice in regard to the control of poultry diseases.

One thousand six hundred and thirty acres of hay land were top-dressed, 768 acres of permanent pasture were top-dressed, and 98 acres of clover and 300 acres of rye plowed under for green manure.

The county agents took 35 farm-analysis records, and 85 farmers have been induced by the agent to keep farm accounts, partial or complete. Four farms have been reorganized as a result of the farm analysis taken. Eight farmers' exchanges were organized during the year. Four hundred and forty-five farmers were supplied with 949 laborers through these exchanges.

The total value of all business done during the year by all associations organized by the agents or on their suggestion was $100,600, effecting an approximate saving of $8,400.

OTHER EXTENSION WORK.

The work of the extension specialists is very closely tied up with the work of the county agents, and no data are at hand describing their activities.

Farmers' institutes are controlled by the board composed of the members mentioned at the beginning of this report. The State legislature appropriated $6,000 a year for the work. There is no written or verbal understanding between the board and the extension division of the institution, but the two work in harmonious cooperation. The direct field responsibility of the work is in the hands of a superintendent. In counties where agents are located, farmers' meetings and short courses are taking the place of the farmers' institutes; and when an institute is held in a county where an agent is located the agent has control of the institute program.

Home economics.—One woman has been employed in this work since September, 1914, and it is contemplated that this section of the work will be increased as rapidly as there is a demand for it.

Boys' and girls' clubs.—Two hundred and fifty-one corn, potato, market-garden, pig, bread, and sewing clubs have been organized,

with a membership of 1,428; 1,047 of these actually began work, and 598 completed the work. This club work is handled in cooperation with the public schools.

In connection with the club work five short courses were held with an average attendance of 70 boys, the course lasting 7 to 10 days. Chambers of commerce and business men usually cooperated in defraying expenses. At these schools the boys were put under military discipline by the college United States commandant, and they were instructed along several lines of agriculture with the aim of giving these boys a vision of what North Dakota agriculture is and what it can become under proper methods. The relationships growing out of these encampments between these groups of boys is very close and effective in opening the way to many changes on the home farm.

OUTLOOK.

Extension work has developed along practical lines adapted to conditions within this State. The practical features of the work begun in connection with the Better Farming Association have been continued and strengthened. The plan involves work and demonstration with farmers in soil management, crop production, the handling of live stock, rural organization, and marketing supported by farming interests.

The county-agent force is a strong, well-knit-together body of agents doing effective work under well-matured plans of the extension division.

OHIO.

Division of Agricultural Extension Work, College of Agriculture, Ohio State University, *Columbus.*

H. C. Price, *Director.*
[C. S. Wheeler, appointed, November 1, 1915.]

History.—The period from 1845 to 1878 was one of agitation both by the college and the State board of agriculture for agricultural extension on the lecture method. The apparent failure in securing results by this method caused no further efforts to be made until 1880.

In 1880 $1,000 was appropriated from the State fair earnings to organize and to hold farmers' institutes under the administration of the State board of agriculture. The number of institutes gradually increased from 27 in 1880–81 to 212 in 1896–97, when every county was visited.

On July 1, 1905, the college of agriculture of the Ohio State University began its extension work by appointing a man as superintendent of agricultural extension. The principal object of his work

was to introduce agriculture into the public schools, to form boys' and girls' clubs, and to organize college-extension teaching in agriculture and home economics for adults.

In December, 1908, the first agricultural-extension school was held for five days at Paulding, in Paulding County. In April, 1909, an appropriation of $20,000 was made for extending the teachings of the college of agriculture to those remote from it. The maximum appropriation of $50,000 was made in 1910, in which year seventy-five 5-day agricultural-extension schools were held. Since that time the appropriation gradually decreased to $38,222.50 in 1914–15.

During the last week of August, 1909, the first formal extension teaching in home economics was done at Amesville, Athens County, as a distinct feature of an agricultural-extension school held at that place for five days.

In January, 1913, the first county agent was employed by the Portage County Improvement Association in cooperation with the Office of Farm Management, United States Department of Agriculture. Other counties employed agents whose work was closely related to the county experiment farms under the auspices of the State experiment station at Wooster. On February 15, 1915, the county-agent work was transferred by the experiment station to the college of agriculture.

The first cow-testing association in the State was organized in Geauga County in 1912 by the head of the dairy department of the college of agriculture. The work in this county was conducted cooperatively with the Bureau of Animal Industry, United States Department of Agriculture. On July 1, 1914, this work was organized as a project of the extension work of the college of agriculture.

In May, 1915, the institutes were transferred by an act of the general assembly to the college of agriculture.

The assent of the governor was given to the terms of the Smith-Lever Act on June 4, 1914.

On July 18, 1914, a memorandum of understanding providing for cooperative extension work with the United States Department of Agriculture was signed by the president of the Ohio State University. The general assembly of the State accepted the terms of the act February 11, 1915.

Organization and administration.—During the year the college of agriculture was organized on the departmental plan and the extension division constituted a department coordinate with other departments in the college. At its head was the dean of the college, and under him were four supervisors, each of whom reported directly to him. One had charge of the extension schools and the field demonstrations and was known as the supervisor of extension schools;

one prepared and edited manuscripts for publication and had general charge of correspondence courses and was known as the supervisor of publications; the head of the dairy department had charge of cow testing and was called supervisor of cow testing; all extension teaching of home economics was under the immediate direction of the head of the home-economics department, who was styled supervisor of extension work in home economics. There were also six specialists in agriculture and six in home economics. A farm-management demonstrator was added to the force on June 7, 1915. The members in the extension division rank as assistant professors in the subject-matter department most closely related to their work. Each instructor is administratively responsible to the director of extension, and is responsible to the head of the subject-matter department for both matter and methods of instruction.

The extension division has quarters in the administration building of the agricultural college. The selecting of extension instructors and the forming of plans for conducting the work are taken up by the director with the heads of subject-matter departments.

During the year the extension division has cooperated with the State agricultural commission in its work in boys' and girls' "contests" by giving instruction to small groups of young people growing corn and baking bread, and with the State department of education in the county normal training schools for teachers. In these normal schools both elementary agriculture and elementary home economics were taught for periods of one week each.

Mailing list and publications.—All correspondence concerning extension teaching is sent to the office of the director, who refers it to the supervisor or instructor having in charge the work nearest related to the subject about which the inquiry is made. Most of the correspondence is filed in the office of the director, but such as is referred to subject-matter departments remains in their files. Requests for seasonal service, such as the spraying of fruit trees, the mixing of fertilizers, etc., are held until a sufficient number are received from one part of the State to justify making up an itinerary for a specialist to make the demonstrations.

The principal publication is the Agricultural College Extension Bulletin. Ten issues of 35,000 copies each have been published during the year and paid for with State funds. One-fifth of the matter consists of announcements and programs, two-fifths agricultural subjects, and two-fifths home-economic subjects. The mailing list is unclassified and contains about 35,000 names made up each year from requests. The mailing stencils show name and date when placed on the list. The bulletins are used principally by teachers and children in the public schools and by county superintendents and ministers. The biweekly news letter is sent to more than 700 newspapers in the

State and to several agricultural papers. Eighty per cent of the newspapers use this service. Several thousand posters and circulars were printed and distributed announcing farmers' week at the college of agriculture and other features of extension work. A reading course composed of seven parts has also been prepared, which is sent free upon request from within the State. All publications were paid for from State funds, except for such time as is given to the preparation of manuscripts and editing by specialists working out other projects in which Smith-Lever funds were used.

Finances.—During the year ending June 30, 1915, there were available for agricultural extension work the following amounts:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative extension work	2,181
United States Department of Agriculture, Bureau of Animal Industry	900
State funds	40,722
Total	53,803

The Smith-Lever funds were used principally in home economics and extension schools.

Of the Smith-Lever fund $8,931.25 was used for salaries of specialists and $1,000 for administration. There remained an unexpended balance of $68.75. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, cow testing, and dairy farming.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

Home economics.—The project in home economics was worked out principally in the extension schools and simultaneously with the sessions in agriculture. The courses presented in the home-economics extension schools ran through five days and included discussions and demonstrations by the instructor in the cooking of cereals, vegetables, and meats, the baking of bread and cakes, and in presenting the most approved methods of serving. The general principles applied to home decoration, to selecting house furnishings, and to sanitation were discussed and illustrated by the use of enlarged pictures and lantern slides. The membership of the schools was secured by a local temporary organization which sometimes resulted in the formation of a farm-women's club. This instruction was also given in the county normal training schools. In these schools for prospective teachers courses very similar to those of the home-economics extension schools were given during five days. The methods were such as should be used in teaching elementary home economics in the rural

and village schools. The use of simple equipment, the cost of preparing foods, and the coordinating of hygiene and physiology with the home-economics lessons were emphasized. In addition 12 meetings were conducted for women's clubs in which instruction and demonstrations were given. In cooperation with the State agricultural commission in promoting its girls' garden and baking "contest" work 11 domestic-science contests and exhibits were attended. The specialists who conducted the work in extension schools and in the county normal training schools also gave the instruction to the women's clubs and to the girls who participated in the contests. The same instructors took part in the home-economics course during farmers' week.

Extension schools.—Forty-four 5-day extension schools were held, having an average attendance of 46 men and 56 women. These schools were of three kinds—dairying, horticulture, and animal husbandry—in each of which soil fertility and crops were given as coordinating courses. Two specialists in agriculture and two in home economics took part in each of these extension schools.

Sixty-five pruning and spraying demonstrations were conducted by the specialist in horticulture and by others who were employed to give him assistance. He also made 20 trips to orchards to give advice, conducted 10 fruit-thinning demonstrations, and prepared 45 landscape-gardening plans for planting school and home grounds. The agronomy specialist conducted 82 fertilizer meetings on farms, 27 field demonstrations in soil fertility and farm crops. The announcements for the fertilizer meetings were made in June for meetings to be held in August and September.

A total of 49 county normal-school courses of one week, 15 in agriculture and 34 in home economics, were conducted. This work was done by specialists who worked in cooperation with the State superintendent of public instruction. Three-fourths of the work done under this project is estimated to be in the form of demonstration.

OTHER EXTENSION WORK.

A project covering demonstration, exhibits, and instruction at fairs was conducted during the early fall by the same instructors who worked in extension schools. The work of each department of the college was represented by an exhibit consisting of models, diagrams, objects, and pictures, and was shown at the State fair and nine county fairs. Nine exhibits were also made at poultry shows.

A Farmers' Week was conducted under the auspices of the extension department at the college of agriculture during the first week of February, 1915. About 1,500 attended, 1,250 of whom were men and 250 women. Most of the instruction was given by lectures. A few demonstrations were conducted, but no member of the school took part in them.

A country-life conference was held during the last of August, 1914, the third held at the college of agriculture—particularly for the benefit of those who are interested in the improvement of the rural church, the country schools, and the social problems of the home.

The extension department cooperated with the State horticultural society, the corn-improvement association, the State dairy association, and the live-stock associations in conducting their winter meetings.

County agents.—County-agent work in Ohio was inaugurated January 1, 1913, by cooperation between the Office of Farm Management, the Ohio experiment station, and the Portage County Farm Bureau. Cooperative demonstration work had been in progress in four districts since 1909. The State law under which a county experiment farm is established requires the State experiment station to select a person to act as a superintendent. On the farm, he conducts experiments on small plats which serve to demonstrate the best practices and methods. Once a year the farmers are invited to assemble at the county experiment farm to view the plats.

When by State law the county-agent work was placed under the control of the State agricultural commission, the superintendents of the county experiment farms were recognized as county agents and were placed on the same basis as regards demonstration work as the agents in counties having no county experiment farms.

On January 1, 1915, cooperative relations were entered into and funds were provided from the United States Department of Agriculture in support of the work. This work was transferred to the extension division of the college of agriculture on February 15, 1915. On July 1, 1914, there were 8 county agents; the number increased to 13 at the close of the year, June 30, 1915. For the half year ending June 30, 1915, the agents reported demonstrations made on farms as follows: Oat-smut control, 94; orchard spraying, 94; pruning, 62; fruit thinning, 15; liming, 106; lime crushing, 9; legume inoculation, 136; green manuring, 14; live-stock associations formed, 6; hog-cholera control, 13; and stock judging, 10.

Boys' clubs.—Boys' stock judging was conducted in about 70 places during 8 summer weeks to coach the boys for the judging contests at 24 county fairs. These meetings were conducted by the extension specialist in animal husbandry, in cooperation with the villages and rural-school superintendents and the management of the county fairs. The extension specialist and sufficient temporary assistants attended each fair to conduct a boys' stock-judging contest, to take charge of the work, to pass on reasons given by the boys for placing the animals, and to assist in making the awards. Over 800 boys reported at fairs to participate in the judging.

Dairying.—The United States Department of Agriculture cooperated with the dairy department of the college of agriculture in

conducting cow testing and in organizing associations for carrying out the work. The head of the dairy department of the college is supervisor of cow testing, but receives no part of his salary from Federal or State extension funds. During the year eight associations have been formed. Eight meetings were held in furtherance of the work of these associations, at which the attendance was 603.

Farm-management demonstrations.—On June 7, 1915, a farm-management demonstrator began work in Geauga County, and during the remaining 23 days of the fiscal year he, with the assistance of students, made 128 farm analysis records. This work was in direct cooperation with the United States Department of Agriculture.

OUTLOOK.

The transfer of the county-agent work from the supervision of the State agricultural commission and experiment station to the supervision of the extension division of the college of agriculture of the State university, and the gradual elimination of the county demonstration-farm features from it, promises to put this work on a more satisfactory administrative footing and to insure greater support on the part of farmers, and more practical and effective work on the part of the agents themselves. Strong features of the extension work in Ohio during the year have been the movable-school work in both agriculture and home economics. The more recent reorganization of the extension division at the college points toward closer supervision and coordination in all lines of extension work within the State.

OREGON.

Division of Extension Work, Oregon State Agricultural College, *Corvallis.*

R. D. Hetzel, *Director.*

History.—Institute work was started in 1888 by the State college of agriculture. Up to this time the growing of cereals and the production of wool occupied the attention of the farmers. There was no thought of soil impoverishment and scarcely any attention given to dairying or other forms of animal husbandry. In fact, at this time domestic live stock, except work horses and fattening swine, had to maintain an existence in the open field throughout the year.

No institute work has been done since January, 1913.

Farmers' institutes were the only form of extension activities provided for by the legislature prior to the enactment of the educational extension act in 1913. This law (1) authorized the agricultural college to carry on educational-extension work in the State; (2) made an annual appropriation of $25,000 for the support of this work; (3) authorized the several counties of the State to appropriate money for

the employment of county agents; (4) provided that the State would duplicate such appropriations with certain limitations; (5) provided that the State would duplicate any appropriations made by Congress or the United States Department of Agriculture for extension work in Oregon conditioned upon such duplication; and (6) appropriated $6,000 per year to the office of State superintendent of public instruction for the boys' and girls' industrial-club work to be carried on in cooperation with the agricultural college. This law was amended by the 1915 legislature so as to limit the appropriation made by the State in duplication of any moneys appropriated by the United States Department of Agriculture to $15,000 per year. It further provided that the State appropriation required to duplicate the Federal appropriation under the Smith-Lever Act should be paid out of the annual appropriation provided in the original act passed in 1913.

The governor gave his assent to the provisions of the Smith-Lever Act prior to May 23, 1914, and the legislature accepted the terms of the act in February, 1915.

Organization and administration.—The extension division was organized in November, 1911, and given jurisdiction over all extension activities. The division is coordinate in rank with the experiment station, and the director of extension is in charge of all work, assisted by an executive secretary, a county-agent leader, an assistant county-agent leader, a boys' and girls' club leader with two assistants, an agricultural editor, and specialists in the several projects.

The status of the extension force as members of the college faculty has not been completely defined. The general understanding of the collegiate rank is that the leaders of county agents and club work rank as department heads and the various field specialists as assistant professors and instructors.

At the close of the present year 33 people were devoting full time to extension work and 31 from one-fourth to half time. In addition to these is a clerical force, and members of the station and subject-matter departments also devote from a few days to several weeks to extension work during each year.

Publications and mailing list.—During the past year 44 extension bulletins and circulars with a total of 201,500 copies were issued, ranging in size from 2-page leaflets to 48-page bulletins. In addition to these there has been published each week a press bulletin of eight columns. This has been sent to all newspapers of the State and to the farm periodicals. The State press bureau was also furnished with thousands of mimeographed and specially prepared stories and articles dealing with agricultural and home-economics subjects for the State press.

Five circulars and seven bulletins with various phases of animal husbandry were published during the year.

This material is prepared by members of extension and subject-matter departments, the latter department approving all matter before it is issued.

The extension publications prepared for general distribution are handled through a central mailing exchange. Lists of available publications are prepared periodically and mailed to the 42,000 persons whose names are now on the station and extension mailing lists. Bulletins are sent as requested. Mailing lists are organized by geographical divisions and also according to interests in various lines of agriculture and home economics.

Correspondence.—Extension correspondence, exclusive of that pertaining to administrative work, lectures, schools, etc., and designed only to give information, in most instances, in reply to letters of inquiry, amounted to 15,096 letters. This corespondence is handled principally by members of the resident staff, who are devoting part time to extension work, and also by the extension staff's specialists.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	7,787
United States Department of Agriculture, Bureau of Animal Industry	2,774
State	56,087
Counties	15,827
Miscellaneous income	265
Total	92,740

The following projects were partially supported by Smith-Lever funds: Boys' and girls' clubs, extension schools and lectures, field demonstrations and advisory work, and home economics.

The Oregon laws provide that the agricultural college is authorized "to engage in, conduct, and encourage educational-extension, demonstration, and field work in all or any of the several counties of the State; the same to include agriculture, horticulture, dairying, domestic science, and other industries." To support this work, the sum of $25,000 per annum is appropriated. The county court of each county is authorized to provide, by tax levy or direct appropriation, not to exceed $2,000 per year for use "in and about agricultural or farm demonstration and field work in such county." For each dollar so provided by such county the State provides another dollar—this in addition to the lump sum of $25,000 appropriated to the college. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the follow-

ing projects: County agents, boys' and girls' clubs, dairy-extension work. A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

Boys' and girls' clubs.—The boys' and girls' club work which is carried on in this State in cooperation with the State department of education as well as the United States Department of Agriculture has proved successful. During the past year the following number of boys and girls were enrolled in the respective projects: Corn, 625, potatoes, 798; gardening, 2,210; canning, 1,020; poultry, 1,043; pigs, 272; bread making, 1,625; sewing, 2,750; handicrafts, 500; dairying, 225; seed grain, 98; fruit, 25; and advanced agriculture, 21—a total of 11,212. Five hundred and sixty-five of these completed all of the work in their respective projects. A large number of those who enrolled made exhibits at the local and county fairs but did not send in reports, and consequently are not counted as having completed their work.

These young people carried on the various pieces of work under the direction of the college officials throughout the growing season, prepared their exhibits and reports for the various school and county fairs, and many of them exhibited at the State fair. It is impossible to estimate the value in dollars and cents to the State of the club work during the past year. While no spectacular yields or results have been achieved, many club members have produced two and three times the average yield of the State in growing such crops as potatoes and corn. Hundreds have demonstrated the value of a small piece of land in growing vegetables. A good many "boarder" dairy cows have been sent to the block as a result of the dairy-herd record-keeping work, and at least 50 boys and girls have demonstrated that it is possible to produce pork in this State at a cost of $3\frac{1}{2}$ cents to 5 cents per pound. Widespread interest has been aroused in home canning both for home consumption and for the market, and as a result these demonstrations will have a direct bearing on the marketing of the by-products of the State and in the elimination of the waste that occurs in practically every section, especially in seasons of overproduction.

Extension schools and lecture courses.—During the past year the extension staff has held meetings ranging from one day to one week, with the total attendance of 112,580 persons. This includes 91 days of itinerant school work at which there were registered 15,065 persons. One-day lecture engagements were attended by 59,872 persons. Most of these meetings were held in connection with the promotion of campaigns along selected lines of work and were either preceded by field work or were followed up at a later period.

Field demonstrations and advisory work.—The central staff of field specialists, consisting of an agronomist, a dairyman, an animal husbandman, a poultry husbandman, a horticulturist, and a highway specialist, gave a total of 193 demonstrations. These included such service, as pruning and spraying demonstrations and follow-up exercises, road repairing, live-stock judging, the handling of poultry, the laying out of drainage systems, etc.; in addition to a great deal of individual advisory service. Field men visited various sections of the State which did not have the services of county agents, advising with the farmers and outlining for them methods of procedure designed to improve their conditions. These specialists also assisted the county agents in much of the demonstration work carried in county-agent territory.

Home economics.—Home-economics extension has consisted largely of general lecture work at short courses and at meetings of women's clubs which have asked for help.

OTHER EXTENSION WORK.

County agents.—County-agent work, the largest department of the service, was supported by funds from the State, county, and United States Department of Agriculture. Agents are located in 12 of the 35 agricultural counties in the State.

Individual assistance has been given to thousands of farmers in the solution of their farm problems. Favorable results were obtained in demonstrations introducing varieties of grains and grasses new to a number of the localities in both eastern and western Oregon. Alfalfa was grown in the semiarid sections to advantage, making it possible to introduce this crop into large areas in eastern and central Oregon. Successful demonstrations were carried on in introducing Sudan grass in both dry and semiarid districts and in the use of red clover under irrigation. A very large increase in both the acreage and the yield of corn was secured. In many sections of the State these yields gave very satisfactory returns.

A great many silos have also been built throughout the State as a result of the county work and the work of the staff's specialists. Considerable progress has been made in cooperative marketing. A number of agents have organized the farmers of their districts into temporary marketing organizations which placed potatoes, hogs, and poultry products on the market at a decided advantage to the farmers. An effective city market was established by the Lane County agent.

A large amount of interest has been aroused in drainage projects in the Willamette Valley and in several of the irrigated districts of eastern Oregon. Farmers have been assisted in the establishment

of private drainage districts, and several large areas will probably be placed under drainage within the near future.

The following things, among others, were accomplished by or at the suggestion of the county agent: Cooperative demonstrations carried on with 821 farmers; 3,278 different farmers were visited; and 7,607 people called on the agent. Forty-five associations of adults were organized, including farm bureaus, cow-testing associations, breeders' associations, farmers' exchanges, public markets and purchasing and marketing associations, and drainage districts. Seed corn was fall-selected on 295 farms. Seed corn was tested for germination on 165 farms, resulting in an average increased yield of 20 bushels per acre on 1,118 acres. Wheat grown on 1,582 acres on 112 farms resulted in an average increased yield of 7 bushels per acre.

Seed oats was treated for smut prevention on 2,872 acres on 181 farms. Oats were grown on 1,550 acres on 80 farms, resulting in an increased yield of 8 bushels per acre.

One hundred and eight farmers treated seed potatoes to prevent scab, and 120 farmers grew 168 acres of potatoes on plans furnished, resulting in an average increased yield per acre of 16 bushels. One thousand one hundred and thirty-seven farmers used the agents' suggestions in growing 3,060 acres of hay, increasing the yield one-half ton per acre. One hundred and eighty-eight farmers grew 1,672 acres of alfalfa on plans furnished. Sixty-seven farmers grew barley and rye on 547 acres on plans furnished. Thirty-six orchards were planted and 211 cared for in whole or in part on suggestions made. Ten farmers successfully tried Sudan grass.

Two hundred and ninety-three breeding animals were secured and 314 other animals purchased. Seven cow-testing associations were organized which provided means for testing the economic production of 3,905 cows, while 529 cows were similarly tested by farmers outside of these associations. Seventy farmers used balanced rations furnished. One thousand eight hundred and thirty-eight animals were examined or treated for disease at the agents' instigation.

Sixty-four farmers used 751 tons of commercial fertilizer and lime. One thousand nine hundred and eighty acres of green crops were plowed under for green manure.

Five farm-analysis records were taken and 211 farmers induced to keep farm accounts.

In 1915 $30,000 worth of business was done by associations organized, making a direct saving of $3,000 to the farmers, and $1,000 was saved by reduced shipping rates secured.

Dairying.—Work in dairying in cooperation with the United States Department of Agriculture, Bureau of Animal Industry, required the services of two men, one working in the eastern part and the other in the western part of the State. This work includes: (1) The

formation of cooperative dairy organizations. (2) Lectures at farmers' meetings. (3) Organizing and directing dairy herd record clubs. (4) Field demonstration work, including the construction of farm buildings, individual record keeping, advice relative to feeding and breeding operations.

During the past year 7 new cow-testing associations have been organized with a total membership of 216 members, placing 3,715 cows under record. The tests have shown that 3 to 6 cows in herds averaging 12 to 20 cows were unprofitable, and that the net returns of the 5 best cows in the average herd amount to three or four times the net returns of the 5 poorest cows. Assistance has been given in the organization of a cooperative creamery, a cream-shippers' association, and a cooperative cheese factory.

Lectures were given at 90 meetings with a total registration of 7,037 persons. In addition to this a number of lectures were given to boys and girls interested in the dairy-club work.

Dairy record-keeping work has been organized in 45 rural schools. This consists of keeping a record of milk production and feed consumption of from 2 to 12 cows in the home herd. The report of this work is taken to the schoolhouse, where it is made the foundation for much of the school practice in arithmetic, composition, etc. In addition to this a number of dairy-judging teams have been organized in rural and high schools and have been supervised and directed.

The field men have aided in the construction of silos, dairy barns, milk houses, etc., helped to bring into the State a large number of pure-bred animals, judged at fairs and exhibitions, and in eastern Oregon done much emergency veterinary work.

Farmers' week.—A session of one week's duration known as the farmers' and homemakers' week and conference sessions was held at the agricultural college the first week in February. There was a total attendance of 2,655. Several of the farmers' organizations of the State convened, and 17 conferences were called. In addition to the benefits derived from the regular instruction the various conferences outlined definite programs for work to be undertaken during the year. Many of these have resulted in accomplishing far-reaching results. For example, the drainage organization inaugurated at that time has secured the survey of several large tracts of land for drainage work and is continuing the campaign with promise that large areas of bottom land will be included in effective district drainage schemes within a very short time.

Hog cholera.—Hog-cholera work was initiated during the year, but had to be discontinued shortly because of demands upon the Bureau of Animal Industry in the East to fight the foot-and-mouth disease. While the work was in progress lectures and demonstrations were given in sections of the State where hog cholera had de-

veloped, and plans for precautionary measures were outlined. Several organizations were created to fight cholera.

Organization and markets.—During the year a bureau of organization and markets was organized, including a field organizer and an office accountant. Business forms, constitutions, and methods of procedure and bookkeeping have been distributed to persons interested in cooperative associations of different types. Assistance has been given to cooperative creameries, cheese factories, and buying and selling associations. Books of a number of cooperative associations have been audited and methods outlined for improving plans of procedure.

OUTLOOK.

The work in Oregon is especially fortunate in view of the fact that State legislation has provided a very substantial financial support for its development. Wherever counties are sufficiently interested to provide their share of the expense money, the State practically automatically provides an equal amount to supplement the county appropriation. This is handled directly by the extension service, and the work can be kept on a very definite basis.

Close coordination of extension work is being developed, and with the liberal financial support and the hearty interest shown by the administrative officers the organization of the Oregon work should develop into a very definite and effective machine for promoting better and more profitable agriculture throughout the entire State.

PENNSYLVANIA.

Division of Agricultural Extension Work, Pennsylvania State College, *State College.*

M. S. McDowell, *Director.*

History.—The first farmers' institute held in Pennsylvania by State authority was on May 22, 1877, when the board of agriculture, which had been created by act of the assembly of May 8, 1876, called a meeting of its members at Harrisburg for the consideration of the agricultural interests of the State. This board was composed of representatives elected by several county agricultural societies, one representative from each of the 67 counties, together with 3 persons appointed by the governor and 6 members ex officio, who were connected with the several departments of the State administration. These 76 representatives had sole charge of the organization and management of farmers' institutes for about 18 years, until the creation of the department of agriculture, when the institutes were transferred to that department. Until 1885 the board of agriculture had no specific appropriation from the State from which to bear the

expenses of the institutes. The expenses were met by the several localities in which the institutes were held, although a small amount was used from the appropriation made to the board for its ordinary expenses in order to meet the traveling expenses of the lecturers.

Among the influences at work during this period in the direction of institute development was the interest taken in the movement by the Pennsylvania State College. In 1882 this institution held a farmers' institute at the college, continuing from January 17 to 27. The course consisted of 40 lectures given by the college professors, aided by specialists, who were secured from outside to present certain important agricultural specialties. No charge was made for the instruction given or for the use of the public rooms of the college. At the end of three years the institutes were discontinued owing to the fact that the attendance was found to be largely local, and also that the maintenance of the course disarranged the work of the institution to an extent that was not, in the judgment of its officers, justified by the results.

In 1885 the legislature made an appropriation of $1,000 to the State board of agriculture for institutes. This appropriation was increased gradually from 1887 until $17,500 per annum was reached in 1905, and the number of institutes increased accordingly.

The extension division at the college was organized in 1907. In the year 1907–8, $3,807.46 was spent for extension work, including salaries. This amount was increased to $22,200.66 for extension work during the year 1913–14.

The governor gave his assent to the terms of the Smith-Lever Act on June 23, 1914, and the State legislature accepted the terms of the act on March 26, 1915.

Organization and administration.—The extension director is in administrative charge of all work, assisted by an assistant State leader of county-agent work, and one worker each in charge of field inspection of farm organization, fair exhibits, and home economics. Extension workers with headquarters at the college have their offices with the subject-matter departments so far as accommodations are available. It is the policy to have all the extension workers very closely affiliated with the departments, both of college teaching and experiment station work. The extension director reports to the dean of the school of agriculture. Members of the extension staff are also members of the college faculty, entitled to attend all faculty meetings and have equal part in faculty action with members of the resident teaching staff.

The extension service in its several fields is conducted in close cooperation with the departments in charge of investigational work. Plans of work are developed by consultation with those departments

and the subject matter taught is approved by the research department concerned.

The teaching and research members of the faculty have taken an active part in extension work. The amount which these departments can undertake is necessarily limited, but each is called upon to assist to the degree that lies within its power.

Besides the 14 county agents employed during the year, 6 people gave full time to extension work, and 25 others a small portion of their time.

Publications, mailing list, and correspondence.—One circular was printed on Smith-Lever funds, Making Grain Mixtures for Dairy Cows, and 11 others were published and distributed in furtherance of extension work. The subject matter of all publications is approved by subject-matter departments before printing.

A list of 35,000 names is used jointly with the experiment station, and all publications, except special leaflets, are sent to the entire list.

Correspondence is answered by the members of extension, subject-matter, or experiment-station department who seem best qualified to handle each inquiry.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	18,442
United States Department of Agriculture, Bureau of Animal Industry	800
State	10,128
College	5,261
County (approximately)	18,000
Miscellaneous	3,000
Total	65,631

The following projects were partially supported by Smith-Lever funds: Administration, fair exhibits, county-agent work, and extension schools. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, cow testing, and dairy farming.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—Mr. A. B. Ross, of Shellsburg, Pa., began in Bedford County what later developed into county-agent work in 1906. This he did on his own initiative and funds. On March 1, 1910, Mr. Ross was reguarly employed by the Office of Farm Management, United States Department of Agriculture, to intensify and

continue the work already initiated by him. He is thus the first county agent to take up work in Pennsylvania and also the first agent placed in the Northern States for what is now called county-agent work by the Department of Agriculture without other cooperation.

From 1910 all county-agent work in Pennsylvania has been cooperative with the United States Department of Agriculture. Pennsylvania had 14 county agents in the field at the close of the fiscal year. This work was financed by Smith-Lever, United States Department of Agriculture, college, county, and farm-bureau funds.

It is believed by the State that the county-agent work affords the best means of solving the problems incident to increasing the farm income and the comforts and desirability of farm life. The work of the specialists is designed to reinforce the work of the county agent, thus bringing directly to the people the most profitable practices in modern agriculture.

The work of the agents consisted in part of calls on 7,021 farmers in 9,000 farm visits. The agents received 6,850 calls at the office on farm-bureau business; 1,372 meetings were addressed, having a total attendance of 124,053 people; 56 associations for adults were organized, with a membership of 1,364; these associations include farm bureaus, cow-testing associations, and farm exchanges; 227 public schools were visited and 422 public schools were assisted in developing agricultural instruction.

On suggestions of the agents during 1915 the following things were accomplished: Sixty-five farm buildings were planned or improved; 113 silos constructed; 12 water-supply systems introduced or improved; 4 lighting systems installed; 16 home grounds planned or improved; sanitary conditions on 21 farms improved; 285 crop-rotation systems planned; 41 drainage systems planned, draining 1,625 acres; 617 miles of public road improved; 37 farm power machines installed; and on 112 farms cement was used.

One thousand six hundred and twenty-five farmers selected seed corn in the fall, planting 8,321 acres; 1,368 farmers tested seed corn for germination, planting 9,420 acres; corn grown on 926 farms, totaling 9,351 acres, resulted in an increase of 19 bushels per acre; wheat grown on 1,065 farms, planting 15,060 acres, resulted in an increase of 12 bushels per acre; 693 farmers treated seed oats for smut, planting 9,691 acres; 541 farmers growing oats, planting 6,415 acres, resulted in an increase of 8 bushels per acre; 21 farmers planted hill-selected seed potatoes; on 210 farms potato seed was treated for scab; 213 farmers grew potatoes, planting 716 acres, resulting in an increase of 28 bushels per acre; 335 farmers grew hay on 4,008 acres, resulting in an increase of three-fifths ton per acre;

301 farmers sowed alfalfa, planting 1,655 acres; 396 farmers inoculated seed or soil for alfalfa for 1,901 acres; 22 farmers grew sweet clover, planting 174 acres; 153 farmers grew soy beans, planting 865 acres; 5 farmers grew cowpeas, planting 61 acres; 15 farmers grew rye, planting 136 acres; 18 orchards were planted and 282 orchards cared for in whole or in part; 5 wood lots planted or improved; 80 farmers treated 32,000 bushels of grain for moth and weevil; 10 farmers grew 35 acres of truck crops; 3 acres crimson vetch were inoculated; on 2 farms 12 acres of vetch was grown for seed; 3 potato variety tests and 5 corn variety tests were conducted.

On suggestion of the agents 448 registered breeding animals were secured; 3 registered sires transferred from one community to another; 432 cows purchased (other than pure breds); 16 cow-testing associations organized, testing 4,342 cows for economic milk production; 727 cows were tested for milk production by individuals on suggestion of agent; 334 farmers influenced to feed more live stock; on 1,032 farms balanced rations figured by county agent were used; poultry suggestions were used on 60 farms; 1,470 animals were tested or treated for diseases; 55 farmers given advice on control of poultry diseases; on 106 farms county agents assisted in controlling foot-and-mouth disease.

Twenty-one farm analysis records were taken, and 7 farmers reorganized their business as a result of these analyses; 56 farmers were induced to keep farm accounts; 266 farmers were assisted in marketing by parcel post; 6 farmers' exchanges organized, doing a business amounting to $2,000; 20 farms were rented through these exchanges and 52 farms supplied with labor; the total value of business done in 1915 by associations organized by the agent or on his suggestion amounted to $5,000, making a direct saving of approximately $1,050; 1 public market was established; and assistance given in arranging 5 leases or contracts between landlords and tenants.

In one county much was done to arouse interest in pure-bred stock as a more profitable source of income. In another county a practical demonstration of profitable marketing was made with the peach crop. A commission man was employed to locate the purchasers and to formulate regulations for grading, packing, and marking. A satisfactory profit was realized in face of what would otherwise have proved a loss. In another county an oat-smut prevention campaign resulted in decreasing the loss about 25 per cent and resulting in an increased value of $5,000 to $6,000 to the 125 farmers who participated.

Extension schools.—During the year two short courses of one week's duration each were conducted. One was held in Philadel-

phia and the other in Pittsburgh. There was a total registration of 900 at each of these schools. Lectures and demonstrations pertaining to the chief agricultural interests of the several counties surrounding these cities were provided.

Fair exhibits.—A display assembled in duplicate consisting of illustrative material and charts was sent to county fairs. During the year this exhibit was shown at 14 fairs and seen by approximately 25,000 people.

OTHER EXTENSION WORK.

Home economics.—Special work was given for women at the winter short course and at farmers' week.

One hundred and forty-two lectures and 35 demonstrations in canning, cooking, and home nursing, where 20,000 people are estimated to have been present were given. Girls' clubs, exhibits at fairs, schools, and women's organizations have had attention.

Boys' and girls' clubs.—Club work is carried on by the home economics worker and by some of the county agents. There was no State-wide project, and no reports are available of work other than that clubs were organized in 23 counties, having a membership of over 5,000.

Dairying.—Attention was given to 18 cow-testing associations, 11 of which were organized during the year. These associations cover 10 counties and represent over 8,000 cows in 484 dairies. Instructions in feeding and herd management have been given and aid rendered to cooperative creameries and breeders' associations. Dairy-farm visits have been made and numerous lectures given. Assistance has been received from the United States Dairy Division.

Farm advisory work.—During the year 100 farm visits, covering 40 counties, were made for the purpose of giving farmers, individually and in groups, assistance in determining general farm policies and methods of operation relating to the several phases of farm business.

OUTLOOK.

The county-agent work is fast becoming established throughout the State, and definite lines of work, outlined in advance, help increase the efficiency of the work and assist greatly in locating results. The definite county-agent projects required from each agent are being found invaluable for all lines of work to save energy, money, and accomplish desired purposes.

The extension forces of the State are being rapidly organized into a compact harmonious force for meeting rural needs, and the outlook for the future of the work in Pennsylvania is assuring.

RHODE ISLAND.

Division of Extension Service, Rhode Island State College, *Kingston.*

A. E. Stene, *Director.*

History.—Farmers' institutes were first held in 1890, and in 1892 the general assembly gave authority to the State board of agriculture to hold agricultural institutes with expenses to be paid out of the general agricultural board fund. In 1904, 12 institutes were held, composed of 21 sessions, having a total attendance of 1,260; expenses were $620; and the lecturers were all members of the State agricultural-college and experiment-station staffs. From the very beginning, members of the college and station faculties have been in close touch with all agricultural-extension work in the State.

The extension division was the first to be organized as a division in New England, being started in 1903. Work has developed slowly, due in part, at least, to the fact that Rhode Island is not an agricultural State, and most of the people are largely residents of villages and cities.

The governor gave his assent to the Smith-Lever Act, May 14, 1914, and the general assembly accepted the terms of the act on April 23, 1915.

Organization and administration.—The extension division is a distinct department of the college on a plane with the experiment station and with the teaching divisions. The director reports direct to the president of the college. The extension workers are entirely separate from the experiment station or from the college department. They all have headquarters in offices adjoining the office of the director. The calls for extension work throughout the State may come to various people connected with the college or experiment-station work. However, nearly all of them come to the extension director and are handled by him. With the organization of the extension staff, the experiment-station and college staffs have been relieved of much of the miscellaneous institute work in which they formerly engaged. They do, however, respond to calls occasionally and take part to some extent in extension work.

Four people give full time to extension work, one person more than half time, and nine less than half time.

The director is a joint employee of the State board of agriculture and college and receives a portion of his salary from each.

Publications and mailing list.—Thirteen publications were printed with Smith-Lever funds and distributed in furtherance of cooperative extension work. These included bulletins describing extension work and desirable practices for the farm and the farm home.

No special extension mailing list is maintained. When bulletins are published, copies are sent only to a selected list, to special correspondents, and are handed out to interested people at fairs and at farmers' meetings. In this way it is believed that waste is prevented and that the bulletins are given out only to those who will make use of them. Press bulletins are issued from time to time. Mimeographed articles on timely topics are sent to the papers of the State, and by this means people are kept informed of the extension work of the institution.

Finances.—The following funds were available for cooperative agricultural-extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	2,242
United States Department of Agriculture, Bureau of Animal Industry	210
State	3,000
College	1,600
Counties	500
Other sources	1,800
Total	19,352

The following projects were partially supported by Smith-Lever funds: Administration, county-agent work, boys' and girls' club work, home economics, and agronomy demonstrations. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, corn testing, and dairy farming. A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County-agent work.—One farm bureau was reorganized from two former bureaus, and two new farm bureaus have been organized during the year, though only one county began work during the calendar year of 1915. One man has given his time to organizing this work, the first county agent being employed in October, 1914. Two cow-testing associations have been organized in cooperation with the Bureau of Animal Industry, United States Department of Agriculture.

Exhibits have been conducted at 7 fairs reaching approximately 40,000 people. One poultry association was induced to adopt a method of standardizing eggs and dressed poultry and to market them under a trade mark registered with the secretary of the state.

Boys' and girls' clubs.—Three thousand six hundred and forty-nine boys and girls were enrolled in corn, potato, home vegetable,

garden, canning, pig, cooking, and other clubs; 2,725 of these members started work, and 1,359 completed their projects.

Thirty-eight canning demonstrations were given with a total attendance of 5,256; 855 field meetings and demonstrations were conducted during the year; 1,454 club members were visited, and 11 club exhibits held.

Home economics.—Some assistance was given to girls' clubs, two months spent in conducting canning demonstrations, but the larger part of the time has been given to home-economics study clubs for women and girls. Twenty clubs with a membership of 503 have been organized. Four courses in sewing were given and 16 in general home economics, which consisted largely in a study of foods.

Agronomy demonstrations.—Fifty-five field demonstrations were taken up with seed corn, alfalfa, rye, vetch, and soy beans. Numerous soil tests for acidity have been made. A plan is under way to certify seed grown under certain restrictions.

Several meetings were held on the test plats to study results.

OTHER EXTENSION WORK.

The extension staff gives assistance to farmers' institutes conducted by the State board of agriculture. The director of extension also acted as entomologist for this board.

OUTLOOK.

Rhode Island is not primarily an agricultural State, but it has large manufacturing interests and consequently a large population to be fed. It is of special importance that the home sources of food supply be developed to the fullest practicable extent. This is being fostered through boys' and girls' club work, the development of marketing associations, county-agent work, and through poultry and gardening demonstrations.

SOUTH DAKOTA.

Division of Extension, South Dakota State College of Agriculture and Mechanic Arts, *Brookings.*

E. C. Perisho, *Acting Director.*
[G. W. Randlett, appointed Dec. 13, 1915.]

History.—The first institutes were held during the winter of 1889–90, at the agricultural college. The attendance at these institutes and those held the next year were so small that the plan of holding them at the college was discontinued and they were afterwards held in different places in the State. Five years later a member of the college faculty was formally placed in charge of institute

work, but no State appropriation was made to meet the expense of the work until 1897, when $1,000 a year was granted and the State engineer made director of farmers' institutes. No appropriation was made from 1900 until 1904, when $5,000 was appropriated for institute purposes, and the oversight of the work was located in the hands of the college. These farmers' institutes are known as short courses, and other arrangements had been made for their supervision prior to the enactment of the Smith-Lever law. As a result of agitation by the South Dakota Better Farming Association, county-agent work was organized in three counties, nominally in cooperation with the agricultural college. The first county organized was Brown County, in March, 1912. This work was made cooperative with the United States Department of Agriculture October 1, 1912.

The governor gave his assent to the Smith-Lever Act, May 19, 1914, and the legislature adopted the provisions of the act, which were certified to by the secretary of state on February 18, 1915.

Organization and administration.—The county-agent work previously referred to was nominally in cooperation with the agricultural college, with the agronomist of the station as county-agent leader. However, full duties were required of him in teaching and experimental work, and but little time was left to be devoted to agricultural extension. During the year there was a change in the presidency of the college, and when the new president was appointed he assumed charge of extension work as acting director of extension, and a State leader of county-agent work was employed, cooperatively by the college and the United States Department of Agriculture. Projects were undertaken covering county-agent work, boys' and girls' club work, and demonstrations by means of specialists in home economics.

Finances.—The following money was available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	5,068
College appropriation	610
State (farmers' institute)	20,000
County authorities	2,097
Other sources within the State	6,448
Total	44,223

The projects of administration, county agents, club work, and specialists in agriculture and home economics were partially supported by Smith-Lever funds. The United States Department of Agriculture cooperated by furnishing funds for the support in part of county agents and boys' and girls' clubs projects.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—County-agent work was in operation in three counties during the year 1914–15, with a county-agent leader employed in cooperation with the United States Department of Agriculture on the basis of his devoting three-fourths of his time to the duties of county-agent leader and one-fourth time to general administration of extension work. The work in the counties was supported by Smith-Lever, United States Department of Agriculture, county, and other funds raised within the State.

At the close of the fiscal year three county agents were at work, but several other counties were in readiness to begin work. The data given below are for the calendar year of 1915 and include work done in 11 counties, though very few agents had been on duty more than a few months.

Among other things the following were accomplished by or at the suggestion of the agent:

Two thousand two hundred and eighty-seven farmers were visited in 4,719 farm visits by the agent and 3,323 farmers called on the agent on county-agent business. At 612 meetings the agents addressed 4,490 people. Fourteen associations were organized for adults with a total membership of 2,098. These included cow-testing associations, farmers' exchanges, antihog-cholera clubs, and purchasing and marketing associations. The agents devoted 275 days to 196 short courses, at which the total enrollment was 12,328.

Two hundred and twenty-two farmers selected seed corn in the fall, planting 4,600 acres. Four thousand two hundred acres were planted with tested seed corn. On the advice of the agent 700 acres were planted to corn, 675 acres of wheat were grown, 4,113 acres of alfalfa planted, 1,183 acres of sweet clover grown, 1,760 acres of barley, and 1,194 acres of rye. Eleven orchards were cared for in whole or in part.

Five hundred and sixty-five animals were secured and 372 registered sires transferred from one community to another. Four hundred and forty-six cows were tested for milk production, 93 farmers were influenced to feed more live stock, 270 farmers adopted balanced rations figured by the agents, and 13,635 animals were treated for disease.

Twenty-nine farmers reenforced manure with acid phosphate or floats and 28 farmers used 30 tons of chemical fertilizer. Seven hundred and twenty-three acres were plowed under for green manure.

Twelve farmers were induced to keep partial or complete accounts. Six farmers' exchanges were organized, doing a total business of $32,175. An approximate saving of $10,000 was effected by associations formed by the agent or on his suggestion.

Home economics.—This work is conducted through the farmers' institutes or short courses. The subjects taken up were largely along the lines of preparation of foods. Some demonstrations were given at these short courses.

Boys' and girls' clubs.—Eighty-four clubs were organized with 2,486 members, of which 799 actually completed the work. Eleven canning demonstrations were given to a total attendance of 655, of which number 355 were club members. Eight field demonstrations were conducted. Ninety-two club members visited; 159 exhibits were held in the State.

OTHER EXTENSION WORK.

The major portion of the extension work was conducted along the lines of farmers' institutes or short courses, at which some attempt was made to select individuals with whom to conduct demonstrations during the coming year. Further reports are not available concerning this work.

OUTLOOK.

The organization of the extension division at the college was attended with many disturbing features, such as changes in the head of the college work, the absence of an extension director, and lack of a State county-agent leader who could give full time to the work.

With the employment of a State county-agent leader in June, who has since become extension director, the extension work in the State is assuming orderliness and efficiency.

Considering the conditions under which work was begun, good progress has been made toward establishing permanent extension work.

UTAH.

Division of Agricultural Extension, Agricultural College of Utah, *Logan.*

E. G. Peterson, *Director.*

History.—Until July 1, 1896, farmers' institute work consisted of occasional lectures by members of the faculty of the agricultural college and the staff of the experiment station. The first farmers' institute law was passed March 28, 1896, appropriating $1,500 a year to the college of agriculture to conduct farmers' and housekeepers' institutes in each county in the State. In 1902 county institutes began to be held upon request of the farmers, which plan continued up to the organization of more intensive extension work.

The agricultural-extension division was organized in 1907 and in 1909 a law was enacted whereby the farmers' institute law of 1896 was repealed and $5,000 a year was appropriated to the agricultural

college with which to conduct general agricultural and home economics extension work. In 1911 the annual appropriation was increased to $10,000. On July 22, 1913, the first county agent began work in Carbon and Emery Counties, under a cooperative agreement between the United States Department of Agriculture and the State college of agriculture. On September 1 of the same year boys' and girls' club work was inaugurated under the same cooperative plan. In 1913 the farm and home demonstration law was passed, appropriating $6,000 the first year, which amount automatically increases at the rate of $2,500 a year until $25,000 a year is reached. The governor assented to the terms of the Smith-Lever law June 29, 1914, and the legislature accepted the terms of the act March 6, 1915.

Organization and administration.—The administration of the extension division is in charge of the director, whose rank is coordinate with that of the director of the experiment station. The extension division is composed of four departments, as follows: Farm management, home management, junior vocational education, and correspondence extension. Each of these departments is in charge of a person who reports to the director. Under the farm-management department there are three subdivisions: County farm-demonstration work, extension specialist, and farm institutes and agricultural schools. The county farm-demonstration work is in immediate charge of the county-agent leader, who has seven county agents working with him. The extension specialists, farmers' institutes, and agricultural schools are in charge of one person, who has direct supervision of specialists doing work in irrigation and drainage, dairying, dry farming, and farm management. The home-management department is supervised by a leader who has charge of the housekeepers' institutes and schools and of home-economics associations. Junior vocational education is in charge of one person, with three assistants—one responsible for boys' club work, one for high-school club work, and one for girls' club work. One man is in charge of the correspondence-course work.

There is no separate State farmers' institute organization, as the extension division is required by law to fulfill the functions of such an organization. The members of the extension staff occupy places on the college administrative council, the college council, and the faculty. The director of the extension division is a member of the administrative council, which consists of the heads of schools and the director of the experiment station. The ten members of the staff are members of the college council, which consists of professors and assistant professors. The county agents are recognized as instructors or assistant professors. The heads of the four departments already named have the rank of professor. There were 21 persons giving

their entire time to extension work, 22 who gave more than half time, and 29 who gave less than half time.

Publications and mailing list.—Forty-four circulars were published during the year. The extension publications were definitely related to the work conducted under the projects. At the beginning of each year an estimate was made by each person working under a definite project as to the amount of printed material which will be needed to work out the details of the project satisfactorily. These were published as prepared during the year and distributed by means of classified mailing lists. These lists are made up each year by reference to the registration lists in the various projects. Publications of a general nature were mailed throughout the State to a list made up of registrations in the institutes and schools, officers in the various churches, commercial clubs, bankers' associations, and others.

Finances.—The following funds have been available for cooperative extension work during the fiscal year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	9,678
United States Department of Agriculture, Bureau of Animal Industry	1,890
State	25,283
County	2,989
Miscellaneous	1,717
Total	51,557

Smith-Lever funds were used in conducting work under the following projects: County agents, home economics, boys' and girls' clubs, farm-management demonstrations, extension specialists, and dairy-demonstration work. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, and dairy-extension work.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 8 county agents, and on June 30, 1915, there were 9 agents working in 10 counties. During the year one new county has been added and the work in one county renewed. The State law directs the college to place farm and home demonstrations in the counties of the State; specifies the duties of the demonstrators; and further requires the college to enter into cooperative agreements with county and State officials, the United States Department of Agriculture, corporations, and individuals. County funds are to be used in paying salary and actual field expenses of county demonstrators, but no county can appropriate more than $2,500 a year for the support of agency work.

Some of the principal lines of work accomplished by the agent or done on his suggestion follow:

Farm buildings planned or improved, 61; silos constructed, 11; crop-rotation systems planned, 50; drainage systems planned, 29; irrigation systems planned, 16. Farmers selecting seed corn in the fall, 28; farms on which corn was grown following agent's suggestions, 778; farmers treating seed oats for smut, 26; farms on which potatoes were treated for scab, 428; farms on which seed or soil for alfalfa was inoculated, 25; orchards cared for in whole or in part, 115; registered male animals secured, 106; registered sires transferred from one community to another, 9; cows tested for milk production by individuals, 878; number of farmers influenced to feed more live stock, 143; farms on which balanced rations figured by the agents are known to have been adopted, 16; animals treated for blackleg, 575; hogs vaccinated for cholera by the agent, 153. Farm records taken by the county agent, 162; farms reorganized as a result of farm analysis, 23; farmers induced to keep farm accounts, 22; and farmers using parcel post in marketing, 103.

Home economics.—No State-wide work was conducted by the leader of the home-economics project. A special project for Sevier and part of Sanpete counties was prepared whereby the home-economics work could be directly and effectively carried into the homes. The officers of the home-economics association of the various towns in these counties at the suggestion of the home-economics specialist, made arrangements for the conducting of demonstrations along lines that would be of most benefit. The equipment used was shipped to one town which was made temporary headquarters. The local cooperators would assist in placing the equipment in homes where demonstrations were to be made. The demonstrator with the assistance of other women who had been invited to a morning's meeting, would prepare the noon meal. By so doing she had an opportunity to discuss kitchen arrangements, working equipment, care of food, and general sanitary conditions. The saving of time in this work was exemplified by using the most approved methods of dish washing and the reduction of the number of towels in the weekly washing. The afternoons were spent in a series of visits to homes from which requests had come for advice in remodeling of kitchen and rooms, decoration, and the treatment of floors. In all, 72 homes were visited; rooms planned and remodeled, 12; homes in which redecorating and rearranging of furnishings had been made, 9; homes in which working schedules had been arranged, 5; homes in which one or more meals had been prepared by demonstrator, 15; the service table had been installed in 14 homes; the dish drainer and iceless refrigerator installed in 18 homes; fireless cooker in 6; and dishwashers in 5.

During the year there have been formed 23 women's associations, which meet monthly or semimonthly. Instruction is given by means of outlines and correspondence courses furnished by the extension department. One of the interesting features of the year's work was a home-planning contest. In several cases these plans have been used in the communities as models for new houses.

Boys' and girls' clubs.—The State leader of boys' and girls' clubs has formed 440 clubs engaged in raising potatoes, sugar beets, poultry, and pigs, and in canning, sewing, baking, and growing flowers. One thousand eight hundred and eighty boys and girls filed complete reports. The administrative expense in conducting this work was $1.77 per member. During the year 75 canning demonstrations were held with clubs and club members, and 3,780 club members were visited at their homes and field plats. Nineteen club festivals, exhibits, and fairs were attended by members of the department during the year. Eight local leaders were paid by the county or district in which they did their work. School credit is being given in some counties for club work. In Sevier County superintendents are now employing agricultural teachers for 12 months and are allowing them to devote 3 months to the club work. The total value of all products resulting from the boys' and girls' club work has been $65,621, or nearly 20 times the total administrative expense for conducting the work.

Farm-management demonstrations.—The farm-management demonstrator made 379 farm-analysis records, 308 of which were returned in person with such recommendations as were thought would increase the efficiency in the management of the farm. Three hundred and two farmers are planning changes in accordance with the recommendations. Three hundred and eight are planning to keep accounts. More than 500 account books have been distributed among the farmers. Many farmers have asked for the books in order to keep their accounts, even though they are not cooperating.

Dairying.—The leader of this project instead of endeavoring to form cow-testing associations put forth considerable effort to instruct the farmers in the making of tests. The owners are encouraged to keep the records in the belief that this work on their part will tend to fix the habit of keeping records of the results of the test better than having the bookkeeping done for them. Much of the milk testing is done by members of the agricultural classes in high schools. Attention is being directed to official testing among pure-bred herds. Cattle from dairy centers are being called for by communities that heretofore have been using cattle of the beef or dual-purpose type. Utah cheese is taking a higher rank on the local and other markets than it has held for years. Five years ago a large percentage of the cheese consumed in Utah was brought from beyond the boundaries of

the State; at present most of the cheese consumed in the State is produced within its boundaries. Throughout the State, feeding is receiving more attention, and as a partial result 60 silos were built during the year. Blue prints have been sent to farmers who are contemplating the building of better barns. Sixty-eight dairy meetings have been held at which the attendance was 6,818.

Extension specialists.—The work under the irrigation and drainage project and the dry-farming project has developed somewhat slowly because interest in large areas had to be created in order that the provisions of the law regarding irrigation and drainage might be applied. In some cases the work of the year has been the continuation of work begun prior to the cooperative agreement between the United States Department of Agriculture and the college of agriculture. Demonstrations have been made in the proper method of irrigating potatoes and the effect of applying different quantities of water at different times. Assistance was given in the use of measuring devices and the installation of such mechanism to determine the amount of water used. Temporary weirs have been installed in several canals, plans for which were taken from a model constructed at a demonstration held before nearly 100 leading farmers. Several hundred acres of new lands have been brought into cultivation from the use of flood waters for early spring irrigation. Many farmers have adopted the late irrigation of alfalfa in the fall as a result of personal talks and demonstrations conducted by the county agent. The leader of the dry-farming project necessarily preceded his demonstration work by holding meetings in numerous settlements and by visiting the leading farmers on their farms, at which time general directions were given. Some time was also spent in visiting new and large dry-farm areas to determine local prevailing factors, such as climate, soil, precipitation, and in a preliminary way ascertaining the possibilities of these various districts. In determining climatic conditions, the United States Weather Bureau at Salt Lake City cooperated by giving information as to rainfall, frost-free periods, etc.

OTHER EXTENSION WORK.

Correspondence courses have been offered under two plans, credit and noncredit courses. Credit courses are those that earn credits on the college records, counting toward graduation, and noncredit courses are those that are outlined to give training in a wide range of agricultural and home-economics subjects, the completion of which does not earn college credits. Two hundred and nine students were registered in the first class and 198 in the second. In the noncredit courses 27 out of 28 counties in the State were represented and also 9 States. This department has cooperated with the leader of the home-economics project by furnishing subjects for study in the home-economics associations of the State.

OUTLOOK.

The State law pertaining to county support for county-agent work is favorable to the growth of county farm bureaus. The benefits that have been derived from the specialists whose work has been cooperative with the agents gives evidence of the value of a county organization to unify extension efforts.

The fact that 80 per cent of the farmers who receive benefit of farm-management demonstrations plan to change their method in accordance with this recommendation shows that this feature of the work is likely to be far-reaching in its results.

Boys' and girls' club work has been conducted in a way to meet the approval of school authorities who in some instances are giving school credit for this work. The market value of club produce was 20 times the total administrative expense for conducting the work, indicating an efficient system of looking after the members during the summer period.

The plan followed in conducting demonstrations in home economics has been such as centered the efforts of the instructor on a few persons with whom home conferences were held and suggestions made. The installation of labor-saving devices and the methods of preparing and serving foods in the home under the supervision of the home-economics leader serves to establish centers which may be examples or suggestions to others contemplating improvements. This is an intensive plan, which may be productive of more permanent results than might result from a State-wide program.

The extension division at the college is thoroughly organized administratively for efficient teamwork.

VERMONT.

Division of Extension Service, College of Agriculture, University of Vermont, *Burlington.*

THOMAS BRADLEE, *Director.*

History.—By an act of the General Assembly of the State of Vermont, approved November 22, 1870, the governor of the State, the president of the State agricultural college, and six persons to be appointed by the governor and confirmed by the senate were constituted the Vermont Board of Agriculture, Manufactures, and Mining. A varying number of institutes were held throughout the several years following, on manufacturing and mining, as well as agricultural subjects. An appropriation not exceeding $2,500 was available for this work until 1894, when the amount was raised to $5,000 and additional duties were placed on the board relating to the inspection and health of domestic animals.

In 1902 the general assembly passed an act constituting the governor, president of the University of Vermont and State Agricul-

tural College, and three persons appointed by the governor and confirmed by the senate, as a board of agriculture, which board was instructed to hold at least one institute annually in each county and employ such lecturers as they deemed expedient.

In 1904, 48 institutes were held with an estimated attendance of 10,000 people. The secretary of the board of agriculture is superintendent of institutes, and the college of agriculture has given active assistance to the secretary in institute work.

The agricultural-extension service was established in accordance with the State law of July 1, 1913, which law appropriates $8,000 annually for extension work. The extension division is a separate and distinct department of the college of agriculture, the director reporting to the dean of the college, who, in turn, reports to the president. The governor gave his assent to the Smith-Lever Act on May 29, 1914, and the legislature accepted the terms of the act on March 11, 1915.

Organization and administration.—The director of extension work is in charge of all work, assisted by an assistant county-agent leader, State agent in charge of boys' and girls' club work, a farm-management demonstrator, editor of publications, and specialists in home economics, dairy husbandry, animal husbandry, agricultural education, horticulture, and forestry. There are nine county agents. These men have collegiate rank corresponding to that held by members of the research and teaching faculty holding similar positions. Sixteen people are employed on full time and six on part time.

Mailing list and correspondence.—All publications are sent to the entire mailing list, which consists of about 10,000 names. Printing of extension publications is paid for out of extension funds and the 44 mimeographed "brieflets" and 2 extension circulars, Prevention of Potato Scab, and Concerning Feeding Practices, were printed and distributed on Smith-Lever funds.

Letters relating to extension work are referred to the extension director who assigns them to specialists in charge of the lines to which the letters refer. It is planned to have the answer sent out through the director's office. A copy of all letters of information sent to farmers is sent to the county agent in the county where the farmer resides.

Finances.—The following funds were available for cooperative extension work for the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	11,062
United States Department of Agriculture, Bureau of Animal Industry	400
State appropriation	8,000
County appropriations	10,800
Total	40,262

In addition to these funds $2,987 was used by the Bureau of Animal Industry in cooperative creamery work in the State. The cooperation was actually with the commissioner of agriculture, but the projects were signed by the director of extension under a system of relationships which appears to be satisfactory.

The following projects were supported in whole or in part by Smith-Lever funds: Administration, county agents, fair exhibits, extension schools, and educational butter scoring. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, creamery-extension work, cow testing, and dairy farming. A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—County agents were maintained in nine counties under funds appropriated from Smith-Lever, United States Department of Agriculture, State, and county sources. Seven of these agents were at work throughout the fiscal year, and among other things the following were accomplished by the agents or on their suggestions:

The county agents made 4,999 visits to 2,504 farmers. Six hundred and eighty-six farmers called on the agents at their offices on county-agent business, and 2,228 telephone calls on county-agent business were attended to. At 338 addresses which were made during the year there was a total attendance of 13,363. Thirty-seven local farmers' clubs and associations with a membership of 654 were formed during the year through the efforts of the agents. Fifty-five agricultural articles were furnished to county papers, and 6,839 informational and advisory letters were written during the year. Twenty-five schools were assisted in developing agricultural instruction, reaching a total of 632 pupils.

Eight farm buildings were planned or improved and 107 farm plans were supplied; the construction of 7 silos was planned; seed corn was fall-selected on 88 farms, and 280 acres planted with this selected corn; and 1,000 acres were planted with tested seed corn.

Thirteen cow-testing associations were formed, and balanced rations were figured by the agents for 79 farmers.

Five hundred and six farmers used 1,050 tons of home-mixed fertilizers, 130 farmers used 531 tons of lime, and 160 farmers were influenced in the better conservation of home manurial resources.

One hundred and thirty-five farm-business surveys were made, and 108 farmers were influenced to keep accounts. Forty-five purchasing and marketing associations were formed through the efforts

of the county agents, and 30 farmers were influenced to use the parcel post in marketing.

Arrangements have been made with 379 farmers for conducting field demonstrations with crops during the coming year.

Exhibits at fairs.—Exhibits were conducted at various fairs, the object being to give farmers an opportunity to have personal conference with the instructors in charge.

Extension schools.—Twenty-three agricultural schools were held with an average registration of 50 and an average attendance of 47. Eighteen home-economics schools were held with an average registration of 62 and attendance of 42 per session. Schools are held in cooperation with the county agent and consisted largely of lectures on a variety of subjects.

Educational butter scoring is intended to assist farmers and creameries to improve the quality of butter by scoring samples once in three months and making an advisory and instructional report to them. One hundred and sixty-five samples of butter were sent in during the year. In July, 1915, the average score of those sending in samples had been increased from 92.77 to 94.48, which entitles this butter to the highest market price. The quality of the butter has been improved and more butter is being made from a given amount of cream with a consequent increase in the profits to the farmers.

OTHER EXTENSION WORK.

Creamery work is done in cooperation between the Dairy Division of the United States Department of Agriculture and the State commissioner of agriculture, though the projects were signed by the extension director. The representative has given assistance to farmers who are patrons of several creameries and has worked with the county agents in counties where agents are located. The relationships have been satisfactory, and good results have been obtained by the farmers who have taken part in these activities.

Boys' camp at fairs.—At the State fair a boys' camp is maintained in cooperation with the fair officials. Each Pomona Grange of the State is permitted to nominate a boy who is to represent this Pomona Grange at the State fair. The college cooperates in providing four instructors who were present during the entire encampment. At certain times during each day the boys were given instruction and demonstrations along the various agricultural lines.

Home economics.—Work in home economics consisted largely of extension schools and exhibits conducted at the fairs.

Boys' and girls' clubs.—The State leader has met 6,106 boys, 6,913 girls, 2,230 men, and 3,397 women, a total of 18,643 in the various communities of the State. He has organized 80 clubs in 65 different

towns and has visited every county in the State, making 270 addresses in 89 different towns. He has held 348 interviews and 166 conferences. He has given 19 canning demonstrations in 10 counties to 1,536 people. He has conferred with 48 school superintendents, 1,361 teachers, and 175 girls preparing for teaching work in the interest of club work. One thousand three hundred and eighty-nine club members began work and 145 completed the work.

Farm-management demonstrations.—This work is conducted in cooperation with the United States Department of Agriculture, States Relations Service. Two hundred and twenty-eight records were taken in the counties of Orleans, Rutland, and Windsor; 208 of these have been returned to the farmers. One hundred and seventy-six farmers are planning to modify their farm procedure so as to increase the likelihood of a more satisfactory income, while 136 are planning to keep some form of farm accounts with a view to stooping leaks in the farm business.

OUTLOOK.

County-agent work is becoming well established in the State, and farmers have shown a very active interest in its extension and development. Satisfactory relations exist between the extension division and the State department of agriculture. The work in the extension schools has contained less demonstration work than will be provided in the future. The provisions of the legislature for State support and county support indicate that the extension work is on a substantial basis and will make good progress in Vermont.

WASHINGTON.

Division of Extension, State College of Washington, *Pullman.*

J. A. Tormey, *Director.*

[W. S. Thornber took office Oct. 1, 1915.]

History.—The early institutes in Washington were held under the provisions of an act approved March 28, 1890, whereby it was a part of the duties of the newly organized college of agriculture and mechanic arts "to hold farmers' institutes at such time and place and under such regulations as it may determine." Only a limited number of institutes were held, as no financial provision was specifically made for the work until 1902, when $2,500 was appropriated with the provisio that "at least one institute shall be held in each county of the State each year." Under this law the president of the college is superintendent of farmers' institutes, and the dean of the college is the field agent and has direct control of the execution of the work.

Under a law approved by the governor on February 28, 1913, there was created the bureau of farm development in the State of Washington, which consists of the director of the experiment station and of the boards of county commissioners of all counties in the State who desire to participate therein. The object of this law was to provide a local agent or expert for each county who "shall give individual instruction and conduct experimental work with the object of improving the agricultural methods and conditions of their counties. They shall perform such other duties as may be required, subject to the general supervision and control of the director of the bureau of farm development." The provisions of this law were set in operation and county farm bureaus started with their control under the supervision of the director of the experiment station. Previous to this county-agent work had been initiated by the United States Department of Agriculture in cooperation with the college, the first county agent being located in Wahkiakum County, November 1, 1912. A memorandum of understanding between the United States Department of Agriculture and Washington State College provided that the supervision of all extension work within the State should come under the administrative control of an extension director. This situation resulted in some misunderstanding and confusion in the county-agent work administratively.

The governor gave his assent to the provisions of the Smith-Lever Act, June 24, 1914, and the State legislature accepted the terms of the act on March 17, 1915.

Organization and administration.—As indicated in the preceding paragraphs, there was a division of responsibility for extension work which continued well through the year 1914–15. The director of the experiment station had partial administrative control of the work of the county agents, as did also the extension director. A vice director held the position of county-agent leader. Besides the officers mentioned, there were employed a State leader of boys' and girls' clubs, with an assistant, a farm-management demonstrator, and specialists in home economics, animal husbandry, and poultry husbandry, two specialists in dairying, one employed cooperatively with the United States Department of Agriculture, Bureau of Animal Industry, and a specialist in soils and crops.

Eight persons in addition to county agents gave full time to extension work and one other person more than half time.

Publications and mailing lists.—All bulletins were issued as experiment-station publications. The Extension News Service was issued twice a month to present brief items and announcements to the papers of the State.

A regular mailing list of about 20,000 names has been organized and will probably be subdivided into groups according to the nature of the information desired.

Finances.—The following funds were available for cooperative extension work during the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	8,901
United States Department of Agriculture, Bureau of Animal Industry	1,603
State appropriation	28,300
County authorities	3,000
Other sources within the State	11,700
Total	63,504

Smith-Lever funds were used in the following projects: Administration, county agents, club work, home economics, farm-management demonstrations, and dairy demonstrations. The United States Department of Agriculture cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, and dairy extension.

A detailed financial report has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—At the beginning of the fiscal year 1914–15 agents were employed in seven counties and three more were added during the year. These agents were supported by Smith-Lever, United States Department of Agriculture, college, State, and county funds.

During the year the county agents visited 3,067 farmers and 3,247 farmers called on the agents at their offices in connection with county-agent work. At 1,358 meetings the county agents addressed a total of 39,615 people. The agents organized 35 associations for adults during the year with a total membership of 1,028. These associations included breeders' associations, cow-testing associations, antihog-cholera clubs, farmers' exchanges, and purchasing and marketing associations. The agents devoted 80 days to 27 short courses, with a total attendance of 4,389.

Eighty-four farm buildings were planned or improved, 8 pit silos dug, and 89 other silos constructed on the suggestion of the agents. Twenty-seven home grounds were improved, sanitary conditions improved on 55 farms, 147 crop-rotation systems planned, 5 drainage systems planned, draining 6,200 acres, and 8 irrigation systems planned, extending over 2,640 acres. Fifteen farm power machines were installed and 89 farmers were given advice with regard to clearing land.

Four hundred and seventy-three farmers selected seed corn in the fall, and 1,582 acres were planted with this selected seed corn. On 186 farms corn was grown according to the suggestions of the agent, planting 1,206 acres with an increased corn yield per acre of 16 bushels. On 24 farms, planting 736 acres, wheat was grown on the suggestion of the agent, with an increased yield of 15 bushels per acre. Fifty-two farmers treated seed oats for smut, planting 1,400 acres with the treated seed. On 138 farms, 1,195 acres of alfalfa were planted following the agents' suggestions, and on 163 farms, 849 acres of sweet clover were so grown. On 232 farms, 4,601 acres of rye were grown on the suggestions of the agents. Two hundred and ninety-five orchards were cared for in whole or in part on suggestion of the agent.

One hundred and forty-seven registered animals were secured on the agents' suggestions and 11 registered sires transferred from one community to another. Four cow-testing associations organized by the agent or on his suggestion tested 2,085 cows for milk production, and 1,493 cows were tested for milk production by individuals on the suggestion of the agent. Six hundred and eighty-six farmers were influenced to feed more live stock, and on 413 farms balanced rations figured by the county agents are known to have been adopted. Four thousand and forty-three animals were treated for disease by the agent or on his suggestion. One hundred and twenty-one farmers were assisted in controlling cholera. Three better live-stock campaigns were held with a total attendance of 3,200.

Two hundred and sixty-four tons of lime or limestone were used, 330 acres of hay land top-dressed, 145 acres of permanent pasture top-dressed, 48 acres of clover plowed under for green manure, 650 acres of vetch, 40 acres of sweet clover, and 2,100 acres of rye were plowed under for green manure.

One hundred and eighty-seven farm-analysis records were taken by the agents, and 124 farmers were induced to keep accounts. One hundred and seventy-five farmers were influenced to use the parcel post in marketing.

The total value of all business done during the year by all associations organized by the agent or on his suggestion was $9,100, with an approximate saving of $850.

Home economics.—Home-economics work was very enthusiastically received, which opened the way to determine the local needs and lay the plans for definite work for the coming year.

Boys' and girls' clubs.—Three hundred and fifty-five clubs were organized, with a total membership of 6,061. Three thousand eight hundred and forty-four members actually began work, and 1,617 members completed the work. The most apparent results of club

work were observed by the impetus and life given to all the fairs and festivals in communities where club work existed, and increased interest in the agricultural and home economics departments in the colleges of the State through the increased rural interest is apparent.

Farm-management demonstrations.—Farm-management demonstrations were begun in November, 1914, and since that time 461 records have been taken, 345 completed, and 90 returned to farmers.

Dairy demonstrations.—Some of the practical things accomplished in dairy work were organizing cow-testing associations, giving advice as to the prevention of disease, inducing men to keep milk records or to construct silos, and holding 40 dairy meetings, with a total attendance of 2,581 persons.

OTHER EXTENSION WORK.

Ninety-seven farmers' institutes occupied 150 days. These included 279 sessions, with a total attendance of 22,000. Five out of the thirty lecturers came from the extension division. Institute work was paid for by State appropriation.

OUTLOOK.

The unfortunate situation of divided responsibility in the administration of county-agent work, further complicated by the change in extension directors, has been corrected and responsibility for the work more clearly placed under the administration of the extension director. The county-agent work as well as extension work along other lines is now proceeding most satisfactorily, and the outlook for helpful extension work throughout the State is bright.

WISCONSIN.

Division of Agricultural Extension Service, College of Agriculture, University of Wisconsin, *Madison.*

H. L. Russell, *Director;* K. L. Hatch, *Assistant Director.*

History.—Four agricultural societies and the college of agriculture were holding meetings of the nature of institutes prior to the enactment of the first farmers' institute law in 1885, carrying an appropriation of $5,000. Two years later the appropriation was increased to $12,000 per year. The law of 1887 placed the responsibility for the farmers' institutes with the board of regents of the State university and gave it power to make rules for their regulation. The institutes of this State have the features of a school and a conference. Since 1895 from 10 to 16 one-day institutes have been held in the cleared-timber districts of the central and northern parts of the State to assist farmers who are making homes there, in addition to

about 70 regular two-day institutes held in the purely agricultural districts. In June, 1909, a law was enacted appropriating $30,000 to the college of agriculture to carry on demonstrations and investigations that were deemed advisable for the improvement of agricultural knowledge and to conduct traveling schools of agriculture which may be held in conjunction with county agricultural schools. In 1911, the appropriation for conducting extension work was increased to $40,000. Since that time the same amount of money has been appropriated annually for this work. In 1913, the legislature enacted a law known as the county agricultural-representative (agent) law, appropriating $10,000 to be used in 1914, and $16,000 for 1915. On January 1, 1913, a cooperative agreement was entered into between the United States Department of Agriculture and the college of agriculture, whereby three county agents began work in Barrows, Oneida, and Eau Claire Counties. The governor assented to the terms of the Smith-Lever Act on June 1, 1914, and on June 29, 1915, the State legislature accepted the terms of this act.

Organization and administration.—The dean of the college of agriculture and director of the experiment station is also director of agricultural extension. The direct administrative responsibility for the extension work is delegated to an assistant director. He has two assistants who have charge of 12 county agents, and an additional assistant has charge of the boys' and girls' club work. The subject-matter specialists appear to be primarily responsible to the heads of their respective departments. Conferences and correspondence with the heads of departments concerning extension activities in the field are conducted by the assistant director.

The total number of persons giving full time to extension work is 16; more than half time, 11. The number of persons who are teachers in the college of agriculture and devote more than half their time to the extension work is 9. Eight persons on the experiment-station staff devote more than half their time to extension work.

Specialists contemplating a trip in the field turn in to the head of their departments a memorandum giving the names of points and persons to be visited. A detailed financial statement has been received and approved.

A very close relationship exists between the Wisconsin Live Stock Breeders' Association, Potato Growers' Association, the State Bankers' Association, and the State Board of Agriculture. The Dairymen's Association receives an appropriation of $3,000 per year, which is expended chiefly in the development of cow-testing associations. The State Bankers' Association has been active in the distribution of pure seeds.

Publications and mailing list.—No especially prepared bulletins are issued by the extension department, but bulletins published by

the experiment station which are considered suitable are sent to those making requests. No separate mailing list is maintained.

Finances.—The following funds have been available for cooperative extension work during the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	11,422
United States Department of Agriculture, Bureau of Animal Industry	388
State appropriation	19,765
County appropriation	10,045
Total	51,620

Smith-Lever funds were used in conducting the projects in county-agent work, extension schools, and farm-drainage demonstrations. The United States Department of Agriculture cooperated by furnishing funds for the support of the following projects: County agents, boys' and girls' clubs, farm-management demonstrations, and cow testing and dairy farming.

The extension funds are in the hands of the State treasurer and are paid out on vouchers issued by the college and approved by the director of extension.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were 9 county agents, and on the same date of 1915 there were 12. These agents were located principally in the new and partially settled counties. The State has appropriated to the college $20,000 for the support of county agents and the counties have appropriated a like sum for their support. The county agent is required by his contract to spend six weeks during the winter months teaching in an agricultural high school.

The following things have been accomplished by the county agents or done on their suggestions during the past year:

Farm buildings planned or improved, 304; silos constructed, 154; crop-rotation systems planned, 195; drainage systems planned, 49; farmers given advice or assistance by the agents in clearing land, 313; farmers selecting seed corn in the fall, 50; testing seed corn for germination, 413; farmers treating seed oats for smut, 20; farmers planting hill-selected seed potatoes, 261; farms on which agent knows that alfalfa was sown following his suggestions, 97; farms on which soy beans were grown according to direction, 62; orchards cared for in whole or in part upon the suggestion of the agent, 35; registered male animals secured, 182; registered female animals secured, 232; sires transferred from one community to another, 30; cow-testing associations organized, 8;

cows tested for milk production through such associations, 2,756; live-stock breeding associations organized, 9; farms on which balanced rations figured by the agent are known to have been adopted, 173; animals tested for tuberculosis, 649; animals treated for blackleg, 105; hogs vaccinated for cholera by the agent, 280; hogs vaccinated for cholera by veterinarian or farmers on agent's suggestion, 600.

Four hundred and forty-one farm analysis records have been taken, and all of them have been returned to the farmers. A total of 21 meetings have been held at which this work was discussed. Six hundred and eighty-four farmers are keeping accounts in whole or in part.

Extension schools.—Extension schools under the name of short courses were in charge of a member of the administration staff, who gives his entire time to this work during the winter months. Eighteen 1-week schools were held, at which the attendance was 945 for the day sessions and 2,125 for the evening sessions. There were also 26 short courses of two or three days. In some of the schools, in addition to the regular lectures, demonstrations were made to show how the Babcock milk test is made and how to test soils for acidity. Pure-seed demonstration meetings are also held under this project for the purpose of increasing interest in the distribution of high-grade seed that has been inspected by the college. The seed is furnished free by the college, and local bankers hold contests and offer prizes for the best exhibits. The extension department furnished a specialist to judge the exhibits and to discuss the subject of high-grade seeds at the close of the contest. At the conclusion of some of these contests the group is organized into a club, such as a potato-growers' association, a corn-growers' association, an oat-growers' association, or an alfalfa association. The farmers who cooperate with the college in this work can have their seed inspected and if passed sell it at an increased price as approved seed.

Farm drainage.—The work of this project had for its purpose demonstrating the importance of thorough drainage by the use of tile drains on marsh lands and on wet clay soils. Nineteen drainage-system demonstrations have been planned during the past year, and 150 farmers have been given definite advice in regard to drainage. Seven meetings have been held on the demonstration areas, attended by about 60 farmers. An engineer from the soil department laid out a complete system of drainage, and the farmer requesting the service bought the tile and dug the ditches. At the meetings held on the demonstration area the drainage system was explained by means of blue prints. In connection with the drainage demonstration a crop demonstration was also planned on the drainage area to show the effects of the drainage.

OTHER EXTENSION WORK.

Demonstration work in dairy husbandry has been conducted principally by the head of the dairy-husbandry department to develop community live-stock associations. Since 1906 the number of Guernsey cattle has increased over 700 per cent. The extension specialist meets with the organization and discusses with the members the methods of feeding and housing of cattle. Judging contests are held and feeding demonstrations made. In the summer the meetings are held in the barns of the farmers. In the winter the matter is presented by means of lantern slides and charts. The preparing of rations is given particular attention. An interest is aroused in the growing of clover, and instruction is given as to proper supplemental foods. During the past year the leader of this project has given 162 lectures and conducted 65 demonstrations before 20,144 persons. Four hundred and forty-four records were taken in connection with farm-management contests. The results of this work seemed to show that it might be advisable to carry on regular farm-management demonstrations, and these may be started near the beginning of the fiscal year.

Boys' and girls' clubs.—Boys' and girls' club work, which has been conducted on a cooperative plan between the United States Department of Agriculture and the college of agriculture, has been along the following lines: Corn growing, potato growing, fruit and vegetable canning, alfalfa growing, poultry raising, bread baking, sewing, and the raising of pigs and calves. In addition to the cooperative work, a seed-corn campaign has been conducted by the college agronomist to encourage extended use of improved seed corn. The State leader of boys' and girls' clubs reports that 90 per cent of the members in the various club projects were enrolled in the one-tenth acre corn-growing contest. for which they received pure-bred seed from the agronomy department. There were 22 clubs growing corn on acre plats; 12 potato clubs, with a total membership of 980; 3 pig clubs; 2 calf clubs; 1 poultry club, with a membership of 9; 2 sewing clubs; and 6 canning and tomato clubs, with a membership of 2,400.

Extension schools in home economics.—The home-economics work was conducted principally in connection with the extension schools and consisted of demonstrations in sewing and cooking. The lecture and laboratory method was followed. The number enrolled in the schools is limited to those who can be given definite daily instructions. The leader of this work has supervision of subject matter taught to the girls' clubs. At the 12 schools held for women there was a day attendance of 419 and a night attendance of 800.

OUTLOOK.

In this State, as in others in which permanent financial support is guaranteed by law to the county-agent work, the increase of agents

has been as rapid as the securing of well-qualified men will warrant. Under the present plan of extension organization the county agent becomes the intermediary between the farmers and the subject-matter departments at the college.

The pure-seed work has developed much interest and has brought the college, bankers, and farmers into close and harmonious relationship.

Though the extension division is not as distinctly segregated a department as in many institutions, the extension work done in the field is of high character, and all the extension forces of the State are working together harmoniously for the advancement of the State's agriculture.

WYOMING.

Division of Extension Work, College of Agriculture, University of Wyoming, *Laramie.*

A. E. Bowman, *Director.*

History.—The first steps toward establishing farmers' institutes were taken at a meeting at Sheridan, October 7–9, 1903. Following this, at the 1903–4 session of the legislature, $2,000 was appropriated for the purpose of holding farmers' institutes and short courses in stock judging, agronomy, and general farming. This work was by law placed in charge of the agricultural department of the university, which arranged the details of the meeting. The first institute was held at Cody, Bighorn County, for three days, March 29–31, 1905. In the fall of 1912, a cooperative plan was entered into between the United States Department of Agriculture and the college of agriculture and experiment station, providing for farm-management studies and field demonstrations. On May 16, 1913, the first county agent was appointed to begin work in Fremont County. This work was financed by the United States Department of Agriculture, the county commissioners, the Fremont County Farmers' Association, and a railroad company. In 1913, the State legislature appropriated $10,000 to be expended by the university for the succeeding biennium for agricultural-extension work. This was the first direct appropriation for general extension work in agriculture and home economics made by the State.

The governor assented to the terms of the Smith-Lever Act on May 26, 1914, and the State legislature accepted the terms of this act on February 11, 1915.

Organization and administration.—The division of extension is a department of the college of agriculture, having at its head a director of extension who is responsible to the dean of the college. There is also a county-agent leader, a State leader of boys' and girls' clubs, a dairy instructor, two home-economics instructors, and nine county

agents. The farmers institutes are by law one feature of extension work, coming under the jurisdiction of the extension division.

Publications and mailing list.—A circular called the Wyoming Farm Bulletin, formerly issued by the college of agriculture and the experiment station, has been published during the past year by the extension division. Poultry-club and general-club circulars were issued and paid for from Smith-Lever funds. The mailing list contains 13,500 unclassified names.

Finances.—The following funds were available for cooperative extension work during the year ending June 30, 1915:

Smith-Lever fund	$10,000
United States Department of Agriculture, farmers' cooperative demonstration work	5,817
United States Department of Agriculture, Bureau of Animal Industry	1,125
State apropriation	5,000
County appropriation	3,800
Organizations	450
Individuals	250
Total	26,442

Smith-Lever funds were used in conducting the following projects: County agents, home economics, boys' and girls' clubs, extension schools, and dairy demonstrations. Out of the $5,000 appropriated by the State, all farmers' institutes and such work as is conducted in teachers' institutes must be paid for. The United States Department of Agriculture has cooperated by furnishing funds for the support in part of the following projects: County agents, boys' and girls' clubs, and dairy extension. A detailed financial statement has been received and approved.

SMITH-LEVER PROJECTS.

County agents.—On June 30, 1914, there were three county agents, and on the same date in 1915 there were three agents, but four more agents began work July 1, 1915.

The county commissioners are authorized to provide and appropriate funds for the support of county-agent work by special provision in the annual tax levy not to exceed one-fourth mill, the same to be expended subject to the approval of the agricultural college. For each dollar so appropriated by the county the State provides $2 to be paid out of the general funds of the State. In no event shall the total amount appropriated by State and county exceed $3,000 in any one county during the year. Two contiguous counties may unite in the formation of a district which is regarded as a single county and is entitled to the same benefits as a county. When any county or district has complied with the provisions for financing

the agent, they shall make a request for a county agent to be sent them by the agricultural college. The board of trustees of the university receives and expends all moneys so appropriated by the county and State. The county agent is the local representative of the extension division, and no work is done in a county having an agent until the opinion and cooperation of the agent is secured. All the work of the State specialists in the counties having agents has been conducted practically under direction of the agents. The principal features accomplished by the county agents follow:

Farm buildings planned or improved, 31; silos constructed, 8; drainage systems planned, 15; farmers given advice in clearing land, 86; farmers selecting seed corn in the fall, 17; farmers treating seed oats for smut, 38; farms on which agent knows that potatoes were treated for scab following his suggestions, 25; farms on which agent knows alfalfa was sown following his directions, 23; registered male animals which the agent knows were secured on his suggestion, 132; registered sires transferred from one community to another, 13; cows tested for milk production, 172; animals tested for tuberculosis, 73; animals treated for blackleg by the agent or on his suggestion, 10,860.

Home economics.—The home-economics specialist did most of her work at farmers' institutes and in the extension schools, where separate meetings were held for women; 31 demonstrations were given in cooking and baking; 23 women's clubs in villages and cities were visited.

Boys' and girls' clubs.—While the boys' and girls' club work has been in charge of a leader, the territory to be covered is so great that the cooperation of the county agents is needed to develop this work. In counties not having agents the cooperation of the county superintendent of schools was secured. In most cases the public-school teacher acted as local leader during the school months, after which it was usually necessary to appoint another leader to continue the work during the summer. Only four projects were taken up—pork and crop production, potato growing, poultry raising, and gardening and canning. Usually only one project for boys and one for girls was permitted in a community. The various clubs held indoor meetings every two weeks during the winter months. During the summer the local leaders visited each member's club plat at least once. The State leader visited the plat of every member in the State, except a few far from the railroad. The number of clubs organized was 44; total number of canning demonstrations, 19. The attendance at all demonstrations for the season was 1,120. Most of the counties awarded prizes to county winners. The State fair association provided over $300 for prizes at the State fair, and the State university awarded two scholarships—one to a boy and one to a girl.

Extension schools.—Under this project only three extension schools or short courses were held. They differ from farmers' institutes in that they continue from four to six days. Where short courses were held the local people were required to do all advertising, furnish a suitable building in which to hold meetings, animals, seeds, soils, and other necessary material for judging and demonstration purposes; further, to provide a suitable place and material for instruction and demonstration in home economics. The subjects selected for discussion are determined upon by the local people and the extension workers. The attendance at the three short courses was 3,186. The places where institutes are to be held and the subjects to be discussed are left largely to the judgment of the county agents in such counties as have agents. The members of the experiment-station staff and the agricultural college faculty assist in giving instruction at farmers' institutes. Occasionally a successful farmer is chosen as a speaker at these meetings. Fifty-six one and two day institutes were held, in which there were 167 sessions for men and 45 for women, with a total attendance at all sessions of 10,315.

Dairy demonstrations.—The dairy specialist made a preliminary survey of conditions throughout the State in order to systematize his work. During this time 62 inquiries were received concerning the building of silos. Nineteen of the persons inquiring gave assurance that they would build silos. Assistance was given in establishing 3 milk routes—2 for creamery trade and 1 for city trade. Sixteen farmers were advised concerning farm buildings; 17 cooperated in keeping dairy records. The dairy demonstrator addressed 37 farmers' institutes, 3 creamery directors' meetings, and gave special dairy work at the three short courses. This work was done in cooperation with the United States Department of Agriculture.

OUTLOOK.

During the year the county agents have been given a free hand in developing plans of work best suited to the needs of the county in which each was working. The State has been specially liberal in aiding the county-agent work. In a county somewhat sparsely populated this aid from the State has probably resulted in forwarding a valuable piece of work which, had it remained for local initiative to develop and support, would have been greatly delayed. The extension division at the college has the work of the State well in hand and is utilizing its funds and extension forces in a manner best calculated to meet the needs of the farming interests of the State.

FARMERS' INSTITUTE WORK, 1915.

By J. M. Stedman, *Farmers' Institute Specialist.*

INTRODUCTION.

Farmers' institute work in the United States during the year ended June 30, 1915, was in charge of the extension divisions of the agricultural colleges in 24 States and directly in charge of the State government in 24 States. Next year 4 States, which have heretofore conducted farmers' institutes as a State activity, namely, Ohio, Oklahoma, South Dakota, and Tennessee, will conduct all farmers' institute work as a part of the activities of the extension division of the agricultural college, and at least two other States are contemplating making a similar change.

The agricultural colleges have always taken an active part in farmers' institute work and in several States have for years contributed the major portion of the institute lecture force. It is but natural, then, that since the inauguration of the Smith-Lever Extension Act giving the extension divisions of the agricultural colleges greatly increased funds, the State itself should withdraw from maintaining an independent agricultural-extension movement and transfer such activities to the now well-organized and endowed agricultural college.

Coincident with the development of the extension activities of the agricultural colleges and the growing tendency to transfer farmers' institutes from direct State control to college of agriculture management have come striking changes in the farmers' institute activities of many States still conducting this work. The State farmers' institute organization, which a few years ago rapidly expanded its horizon so as to include women's institutes, institutes for young people, movable schools, railroad instruction trains, demonstrations, various special institutes, etc., has abandoned many or all these later activities and now confines itself to the holding of regular farmers' institutes, which in many cases are either the two-day or one-day meetings. The decided tendency is to allow the extension division of the agricultural college to conduct miscellaneous extension work. This may be largely accounted for on the grounds that the Smith-Lever Extension Act provides for work in home economics for the women and for the young people through the club work. With a few notable exceptions, the State farmers' institute has now given up everything except the regular farmers' institute work and the round-up meetings.

GENERAL STATUS OF FARMERS' INSTITUTES.

Of the 24 States which this year had direct charge of their farmers' institute work, 3 (Maine, Vermont, and Virginia) have not reported, and 3 (Louisiana, Oklahoma, and Tennessee) did not hold institutes. Of the 18 States reporting as having held institutes, 2 (Pennsylvania and South Dakota) held movable schools; 2 (New Jersey and Texas) ran railroad instruction trains; while 2 (Texas and Michigan) held one young-people's institute each, and 4 held women's institutes. The women's institutes were held as follows: North Carolina, 240; South Dakota, 152; Michigan, 56; and Texas, 1. The 18 States reporting held in all 4,508 regular institutes, lasting 5,791 days, with a total of 12,167 sessions and an attendance of 1,785,215. The round-up, independent, and other special institutes held by these same 18 States included 880 sessions, with an attendance of 174,177, and the attendance at the movable schools and railroad instruction trains was 33,376. The grand total for all forms of State institutes for the 18 States reporting was 13,059 sessions, with 2,115,266 people in attendance. Of the 516 lecturers which the States utilized, 196 were secured from the agricultural colleges and experiment stations, and these gave 911 days of service to the work. The total State appropriation for such farmers' institute work was $208,175.56.

Of the 24 States in which the farmers' institute work was in charge of the extension division of the agricultural colleges, 4 (Oregon, Nevada, New Mexico, and South Carolina) did not hold institutes. The 20 States reporting as having conducted farmers' institutes under college control held in all 4,561 institutes, lasting 4,799 days, with a total of 9,074 sessions, at which there were 1,039,501 people in attendance. The extension-division staff taking part in this work furnished 277 lecturers, and there were utilized from outside sources 2,422 additional persons, of which number 2,000 were in the single State of Kansas. Kansas, therefore, stands in a class by itself in this respect among those States whose extension divisions conducted farmers' institute work. In no other State has the extension division utilized any considerable number of outside lecturers. State funds were used for institute purposes to the amount of $129,811.78, and other funds to the extent of $21,062.45, making in all $150,874.23 for farmers' institute work in the 18 States reporting.

Summing up all the farmers' institute activities in the United States for the year as conducted by both the State and the agricultural college as far as reported to the States Relations Service, it will be seen that there were held during the year 9,059 regular farmers' institutes lasting 10,590 days. The total number of sessions

of regular, independent, round-up, and other special institutes was 22,133, and the total attendance at all farmers' institute activities, including movable schools, and railroad instruction trains was 3,154,767. The State appropriation for the entire work was $337,987.34. This sum was supplemented from other sources to the extent of $65,089.06, making in all available for farmers' institute work in the United States during the year $403,076.40.

More detailed information respecting the farmers' institute work in each State may be obtained by studying the tables accompanying this report.

It should be noted that the movable schools, railroad instruction trains, work with young people, either within the schools or without, and home economics with women, are not regarded by the agricultural colleges as farmers' institute work and are therefore not here reported, although these activities are so regarded by the States directly conducting farmers' institutes.

DIVISION OF FARMERS' INSTITUTES.

The farmers' institutes division of the States Relations Service continued to aid all institute workers along the same lines as heretofore. The 18 different syllabi of lectures, accompanied with about 50 lantern slides each, were in such constant demand that in spite of a 200 per cent increase in the number of duplicates of certain lectures it was impossible to supply all the requests for their use. Three additional lectures were added during the year, and four others were prepared and are being published. Each of these lectures is a condensed résumé of the best available information on the subject with which it deals. Some of the earlier lectures have been revised and brought up to date, or are in course of revision. The older lantern slides are also being revised and greatly improved, and an effort is being made to publish only the best obtainable illustrations. Slides are being colored whenever this will add materially to their teaching value.

Every effort has been made to keep farmers' institute lecturers supplied with Department of Agriculture publications of special interest to them.

AGRICULTURAL-EXTENSION WORK IN FOREIGN COUNTRIES.

Owing to the war in so many European countries agricultural-extension work abroad has either ceased entirely or is attracting no attention, and as a result little new information on this subject has come to our attention. It may be of interest to note in this connection, however, that Russia is conducting extension courses in agricultural subjects for wounded soldiers in its larger hospitals, and

that Germany is conducting special extension courses for women to instruct them in agricultural and home-economics subjects in order that they may be better able to take the place of men on the farm and conserve the food supply for both stock and people.

STATE REPORTS.

Detailed information respecting farmers' institute work in the several States is given in the statistical tables accompanying this report. Numerous items of interest showing the progress of the work, but which are incapable of tabulation, appear in the report of the directors from those States in which the farmers' institute work is directly conducted by the State. In order that these features may be known by the body of workers, the principal points are referred to in the following account under the names of the respective States:

Alabama.—Farmers' institute work in Alabama was confined to the holding of 33 one-day regular institutes and 1 of two-day duration.

Delaware.—Farmers' institute activities in Delaware during the year were confined to the holding of 22 one-day meetings of regular institutes and 1 two-day meeting.

Illinois.—Quarantine regulations regarding foot-and-mouth disease of cattle, as well as civil-service regulations, greatly handicapped the farmers' institute work during the year in spite of the total appropriation for the work from all sources of $35,320. No women's or young people's institutes were held, but the State has 369 household-science clubs, each meeting twice a month, and the institute director supplies speakers to these meetings as well as to local institutes, farmers' study clubs, and better farming associations, throughout the year when these organizations meet the requirements of the board of directors. A field worker is continually employed in organizing, visiting, and assisting local organizations.

Iowa.—Each county in Iowa is by law entitled to received from the State not to exceed $75 each year to reimburse it for farmers' institute expenses, provided they make a proper report to the State department of agriculture before the first day of June. Each county has its own farmers' institute organization, and it alone arranges for the dates, places, and program of its meetings. While by law the secretary of the State board of agriculture has charge of the farmers' institute work of the State, his duties in this respect are confined to the following: To receive annual reports of farmers' institute work in each county and, if proper, to reimburse each not to exceed $75 per year. The real work of managing and conducting farmers' institutes is in the hands of each county organization, and

they enlist the services of the extension department of the agricultural college, which sends its staff of lecturers as their duties permit. An effort is now being made to have the institutes arrange their dates so that they will come in a circuit. This will enable more of them to take advantage of the lecturers from the extension department of the agricultural college. As it has been up to this time, the dates often conflict.

Kentucky.—Six times as many two-day institutes as one-day meetings were held, all of which were mixed, there being no women's institutes or institutes for young people. In all there were 328 sessions, and the cost was $6,091.42.

Louisiana.—No farmers' institutes were held in Louisiana during the year.

Maine.—No report of the farmers' institute work in Maine has been received, and no information is available from other sources.

Maryland.—Farmers' institute activities were confined to holding regular general institutes, of which there were 54 one-day and 15 two-day meetings, with a total of 205 sessions. No women's or young people's institutes were held, and no other form of institute activity was contemplated, all these having been assumed by the extension department of the agricultural college. General use was made of lantern slides and charts, and nearly all of the work was done by State institute lecturers, with very little help from the college or station employees.

Massachusetts.—Under the law each incorporated agricultural society must hold at least one institute. The farmers' institute director cooperates with these societies and sends lecturers to the meetings. He also holds a summer field meeting and a public winter meeting lasting three days. In all 81 lecturers were engaged during the year.

Michigan.—The most striking feature of farmers' institute work in Michigan during the past year is the number of local speakers used, namely, 1,500. This is so far ahead of the number used by any other State director as to place Michigan in a class by itself in this respect among the States directly conducting institutes. The number of one-day meetings was five times that of the two-day meetings. Fifty-six one-day women's institutes were held, mostly consisting of but one season, however. Only one young people's institute was held.

Missouri.—As new features introduced into the institute work this year may be mentioned county campaigns for alfalfa, better seeding, emergency crops, silo building, better live-stock sires, and organization of dairies and creameries. Women's institutes have been entirely turned over to the extension division of the agricultural college. Illustrated lectures have been featured with unusual interest,

and chart lecturing has been found advantageous. The demand has so far exceeded the force that one-man institutes have been held. While the funds for farmers' institutes are now larger than at any time in the history of the board, they are in great need of still more funds.

New Hampshire.—New features of the work during the year included demonstrations in poultry killing, fruit packing, and cattle judging. More special institutes were held than general institutes. No women's or young people's institutes whatever were held. The total cost was $883.53.

New Jersey.—The State appropriation for farmers' institute work last year was $2,656.18, which includes the salary of the director. All institutes held were one-day meetings except a single two-day institute. No women's or young people's institutes were held, and the 140 sessions of regular institutes had a total attendance of 7,725.

New York.—The farmers' institute work of New York continues to maintain a high state of efficiency, not only as regards regular institutes, but also as regards the other extension features which constitute secondary phases of the work. Three persons were employed in field demonstrations and individual advisory work, and two other persons were employed to organize cow-testing associations. The institutes are apportioned to the counties according to the number of farms in each and range from 2 to 12 days. The director arranges for the places and program of the meetings at a conference in each county. A conference consists of farm-bureau managers, masters of the grange, supervisors, district-school superintendents, and persons who have acted as local correspondents for the two preceding years. The dates are afterwards arranged by the director. Twelve thousand of the director's reports were published and distributed. This report consists of two parts, the second part being the New York State Farm Home and Suggestions for the Housewife. Besides these reports three bulletins, each containing from 200 to 368 pages, were published and distributed, the subjects being swine, poultry, and vegetables. New features introduced during the year were farm-survey work in parts of three counties and follow-up work for women. Women lecturers were sent to places where they had previously been at the regular institute meeting to continue the work for several days longer. Close cooperation was maintained between the farmers' institute and the extension department of the agricultural college, and also with the county agents and farm-bureau managers. Assisted by the farm-bureau managers, the farmers' institute expended during the year $1,886 in organizing and maintaining 40 cow-testing associations. At the request of farm-bureau managers the farmers' institute has held many miscellaneous meetings and rendered other services for the cause of agricultural

extension. Special emphasis was laid during the year on farm management.

North Carolina.—The farmers' institute work this year consisted of 261 one-day meetings of regular institutes, one meeting of longer duration, and 240 women's institutes of one day each. A new feature was the organization of local women's institutes to meet monthly or as often as convenient. No young people's institutes were held, and neither the college of agriculture nor the experiment-station forces were utilized.

Ohio.—During the year 2,135 sessions of regular farmers' institutes were held at a total cost of $31,076.66. Women's sessions were held in connection with the two-day general institutes, which were thus mixed sessions. All institutes were of two days' duration. Under the new law all the farmers' institute work of Ohio is hereafter to be conducted as a part of the work of the extension division of the agricultural college.

Oklahoma.—No farmers' institute work was conducted in Oklahoma during the year. The State legislature has repealed the farmers' institute law, and hereafter all farmers' institute work in the State will be conducted as a part of the duties of the extension division of the agricultural college.

Pennsylvania.—No separate women's or young people's institutes were held, but at every two-day institute a woman's session was introduced. Nearly all institutes are now two-day meetings. One hundred and fifty local speakers assisted the director whose State force numbered 45. A feature of the institute work in Pennsylvania is the 10 county demonstrators or advisors whose whole time is devoted to field work with individual farmers. While $22,500 was expended for farmers' institute work last year, still larger appropriations are needed to carry out the general plan outlined. The lines of work receiving special attention during the year were farm demonstrations, lantern-slide illustrations, and cooperation in buying and selling farm products.

Rhode Island.—No special appropriation was made for farmers' institute work, but the secretary of the State board of agriculture with the help of the agricultural college held 20 farmers' institutes and one round-up institute and also conducted a series of lectures on home and school gardens which reached 1,700 boys, girls, and adults.

South Dakota.—In marked contrast to most farmers' institute work during the year South Dakota has conducted 152 women's institutes, which is more than half as many institutes as were held for the men. It also conducted 56 movable schools for women which is as many as those for the men. No young people's institutes were held. No college or station lecturers were employed and no local speakers used. The State force consists of 19, and the total expenses were

$21,679.08. According to a new law all farmers' institute work in South Dakota will hereafter be carried on as a part of the activities of the extension division of the agricultural college.

Tennessee.—No farmers' institute work was conducted by the State during the year. While the State law has not been changed, during the last legislature an agreement was reached between the governor and the parties concerned by which the extension division of the agricultural college will hereafter conduct farmers' institute work instead of the State.

Texas.—Farmers' institute work in Texas is carried on during the entire year, and its cost for the year just closed was $27,799.92. Two women are devoting their entire time to home-economics work and three men to marketing. Only one institute for young people and one for women were held.

Vermont.—No report of the farmers' institute work in Vermont for the year was received.

Virginia.—No report was received regarding farmers' institute work in Virginia for the year.

TABLE XVIII.—*Farmers' institute work conducted by the State, 1914–15.*

State.	Regular institutes.				Miscellaneous institutes.								Grand totals all forms of institutes.	
	Total number of institutes.	Total number of days of institutes.	Total number of sessions.[1]	Attendance.[2]	Movable schools.		Railroad specials.		Round-up, independent, and other special institutes.			Attendance.[2]	Number of sessions.[1]	Attendance.[2]
					Number.	Attendance.[2]	Stops.	Attendance.[2]	Number.	Number of sessions.[1]	Attendance.[2]			
Alabama	34	35	57	5,785									57	5,785
Delaware	23	24	57	7,744									57	7,744
Illinois	191	343	826	173,059					1	9	3,000	3,000	835	176,059
Iowa	93		810	157,214									810	157,214
Kentucky	88	164	328	17,134									328	17,134
Louisiana [3]														
Maine [4]														
Maryland	69	84	205	29,797									205	29,797
Massachusetts	145	145	181	19,525					2	8	1,975	1,975	189	21,500
Michigan	597	700	1,565	211,655					8	37	15,046	15,046	1,602	226,701
Missouri	299	412	626	104,146									626	104,146
New Hampshire	15	18	40	4,145					48	48	5,600	5,600	88	9,745
New Jersey	56	57	140	7,725			12	400	2	9	1,500	1,900	161	9,625
New York	380	406	1,207	101,498					75	138	15,850	15,850	1,345	117,348
North Carolina	502	504	1,010	71,819					1	8	3,000	3,000	1,018	74,819
Ohio	427	854	2,135	478,240					91	455	93,963	93,963	2,590	572,203
Oklahoma [3]														
Pennsylvania	231	455	1,210	165,280	7	11,908			57	141	29,556	41,464	1,351	206,744
Rhode Island	20	21	26	2,755					1	5	1,300	1,300	31	4,055
South Dakota	378	515	541	55,396	112	110,590						110,590	541	165,986
Tennessee [3]														
Texas	960	1,054	1,203	172,298			110	32,976	22	22	3,387	36,363	1,225	208,661
Vermont [4]														
Virginia [4]														
Total	4,508	5,791	12,167	1,785,215	119	122,498	122	33,376	308	880	174,177	330,051	13,059	2,115,266

[1] A session is a half-day or evening meeting.
[2] Attendance is the sum of the attendance at each session.
[3] No institutes.
[4] No reports.

TABLE XIX.—*Farmers' institute work conducted by the States, 1914–15.*

State.	Number of lecturers.				Amount of State appropriation used for institute work.	Other funds used.	Annual reports.	
	From colleges and stations.	From other sources.	Total number.	Days contributed by college and station lecturers.			Published.	Number of copies.
Alabama					$600.00		No.	
Delaware	8	7	15	62	1,000.00		No.	
Illinois	32	89	121	161	26,550.00	$8,770.00	Yes.	50,000
Iowa					5,219.38	27,932.66		
Kentucky	5	4	9				Yes.	10,000
Louisiana [1]								
Maine [2]								
Maryland	4	14	18		6,000.00	968.21	No.	
Massachusetts	33	48	81	45	6,000.00		No.	
Michigan	10	30	40	50	8,500.00		Yes.	12,500
Missouri			3		10,750.00			
New Hampshire	10				2,000.00		Yes.	
New Jersey	22	7	29	131	2,656.18		No.	
New York	18	2	20	53	33,000.00		Yes.	12,000
North Carolina			35		12,000.00		Yes.	35,000
Ohio	25	16	41	330	26,400.00	4,676.66	No.	
Oklahoma [1]								
Pennsylvania	10	35	45	60	22,500.00		Yes.	8,000
Rhode Island	19	7	26	19			No.	
South Dakota			19		20,000.00	1,679.08	No.	
Tennessee [1]								
Texas			14		25,000.00		Yes.	10,000–20,000
Vermont [2]								
Virginia [2]								
Total	196	259	516	911	208,175.56	44,026.61		

[1] No institutes. [2] No reports.

TABLE XX.—*Farmers' institute work conducted by the extension departments of the agricultural colleges, 1914–15.*

State.	Number of institutes.	Total number of days of institutes.	Total number of sessions.[1]	Total attendance.[2]	Number of lecturers—			Amount of State appropriation used for institutes.	Other funds used.
					From extension staff.	From outside sources.	Total number.		
Arizona	14	14	17	1,543	3	0	3	$100.00	$150.00
Arkansas	823	90	952	102,580	14	26	40	6,236.65	
California	59	92	164	10,441	12	4	16	8,000.00	
Colorado	78	83	143	9,036	24	3	27	(3)	(3)
Connecticut	32	32	59	1,992	15	17	32	865.20	
Florida	168	149	279	25,222	7	139	146	10,000.00	None.
Georgia	60	60	120	19,642	12	10	22		
Idaho	180	400	870	13,000	24	12	36	2,500.00	None.
Indiana	450	597	1,395	274,187	17	33	50	10,002.86	6,808.45
Kansas	440	499	1,008	93,713	10	2,000	2,010	9,000.00	2,000.00
Minnesota	93	134	274	48,710	....	16	16	4,723.92	
Mississippi	496	496	620	77,128	19	6	25	9,000.00	None.
Montana	144	123	185	18,934	14	27	41	10,000.00	
Nebraska	178	111	602	79,245	13	41	54	10,000.00	12,104.00
Nevada [4]									
New Mexico [4]									
North Dakota	696	696	(5)	53,466	26	7	33	6,000.00	
Oregon [5]									
South Carolina [4]									
Utah	181	201	287	34,923	15	22	37	10,000.00	None.
Washington	97	150	279	22,010	5	25	30	4,920.22	None.
West Virginia	[6] 116	429	858	64,135	24	12	36	7,349.69	
Wisconsin	198	367	750	79,279	15	12	27	20,000.00	
Wyoming	58	76	212	10,315	8	10	18	1,113.24	None.
Total	4,552	4,799	9,074	1039,501	277	2,422	2,608	129,811.78	21,062.45

[1] A session is a half-day or evening meeting.
[2] Attendance is the sum of the attendance at each session.
[3] Not available.
[4] No farmers' institute work done.
[5] No record.
[6] Independent institutes held by local communities, 208.

TABLE XXI.—*Expenditures from the United States appropriation of May 8, 1914, for cooperative agricultural extension for the year ended June 30, 1915, by items of expense.*

State.	Amount of appropriation.	Classified expenditures.														
		Salaries.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.	Unexpended balance.
Alabama	$10,000	$3,908.96	$269.41	$485.03	$320.52	$191.57	$5.00	$371.23	.....	.....	$236.40	$226.74	.....	$3,985.14	.....	.....
Arizona	10,000	5,189.68	155.19	74.25	504.04	329.63	10.70	142.30	.....	$74.73	504.05	43.00	.....	2,961.23	$8.20	.....
Arkansas	10,000	7,580.45	.....	306.25	150.90	73.95	.....	98.22	.....	.....	550.32	.....	.....	1,239.91	.....	.....
California	10,000	7,850.01	963.91	.....	108.59	10.56	.....	82.80	.....	10.38	213.14	205.50	.....	555.11	.....	.....
Colorado	10,000	3,095.16	466.61	117.75	754.36	368.46	.....	237.99	$5.32	12.80	516.02	191.45	.....	4,234.17	.....	.....
Connecticut	10,000	6,790.50	126.16	221.25	300.19	64.05	.....	197.22	2.00	36.44	282.02	34.70	$21.30	1,908.89	.....	$15.28
Delaware	10,000	7,524.53	4.51	129.50	282.00	226.97	.....	245.70	5.11	5.75	309.91	54.00	.....	1,204.52	7.50	.....
Florida	10,000	9,040.45	83.20	391.24	59.35	37.01	.....	51.66	2.14	.....	39.50	.....	.....	220.45	.....	75.00
Georgia	10,000	3,825.80	167.75	500.00	443.21	382.67	128.75	419.45	.....	29.00	874.05	244.20	141.04	2,770.47	.75	72.86
Idaho	10,000	6,929.85	46.08	271.25	134.10	124.53	1.00	82.15	3.00	5.45	.....	44.40	.....	2,356.19	2.00	.....
Illinois	10,000	7,672.68	2.74	65.50	109.81	47.55	.....	63.21	49.60	163.50	1,394.82	92.54	.....	338.05	.....	.....
Indiana	10,000	7,104.42	766.50	.....	284.25	49.44	.....	110.35	.....	4.25	223.00	.....	.....	1,457.79	.....	.....
Iowa	10,000	8,537.13	.....	.....	.....	.....	.....	.....	.....	.....	188.11	.....	.....	1,274.76	.....	.....
Kansas	10,000	9,864.01	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	135.99	.....	.....
Kentucky	10,000	4,404.92	5.15	301.20	168.50	122.04	.....	95.20	.....	.....	994.93	.....	.....	3,782.69	.....	125.37
Louisiana	10,000	6,077.57	.....	447.03	34.25	.....	.....	.....	.....	.....	.....	.....	.....	2,064.49	.....	1,376.66
Maine	10,000	5,898.56	.....	276.56	374.86	.....	.....	6.47	29.72	570.02	173.75	84.00	.....	2,542.35	43.71	.....
Maryland	10,000	5,212.92	889.73	157.50	176.35	189.04	.....	609.19	.....	95.79	322.84	353.79	.....	1,742.85	.....	250.00
Massachusetts	10,000	5,902.60	.....	500.00	.....	.....	.....	242.93	.....	.....	176.90	.....	.....	3,177.57	.....	.....
Michigan	10,000	8,804.29	8.63	389.50	.....	9.63	.....	.....	.....	.....	.....	.....	.....	787.95	.....	.....
Minnesota	10,000	7,912.06	152.00	.....	16.91	32.52	.....	3.10	.....	2.25	.....	.....	.....	1,877.66	3.50	.....
Mississippi	10,000	6,520.82	.....	96.05	162.05	249.66	.....	79.07	.....	.....	69.00	24.00	.....	2,799.35	.....	.....
Missouri	10,000	6,587.60	65.68	48.50	691.46	114.32	.....	171.29	.....	.....	113.03	6.10	.....	2,202.02	.....	.....
Montana	10,000	9,247.46	21.00	73.50	78.40	27.84	.....	2.84	.....	.....	147.00	.....	.....	491.96	.....	.....
Nebraska	10,000	7,555.43	7.35	.....	557.73	11.76	.....	36.38	.....	.....	.....	.....	.....	1,820.40	10.95	.....
Nevada	10,000	4,316.97	4.75	60.00	269.08	66.38	.....	53.01	2.00	186.71	440.07	75.40	.....	2,019.03	.....	2,506.60
New Hampshire	10,000	6,316.47	240.20	.....	187.87	68.44	.....	180.54	18.05	7.44	688.56	78.28	.....	2,212.05	2.10	.....
New Jersey	10,000	7,280.82	.....	493.07	209.71	28.95	.....	295.71	17.05	33.80	395.25	58.17	.....	1,171.29	.....	13.18
New Mexico	10,000	3,953.62	19.58	390.00	239.64	77.87	.....	19.19	81.57	47.88	598.68	182.35	.....	4,389.62	.....	.....
New York	10,000	6,449.34	232.39	.....	321.56	51.88	.....	220.55	.....	35.10	329.13	.....	.....	2,360.05	.....	.....
North Carolina	10,000	6,958.77	252.48	227.94	152.12	30.28	1.40	58.15	.....	109.11	847.14	2.80	.....	1,359.81	.....	.....
North Dakota	10,000	8,870.27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,129.73	.....	.....
Ohio	10,000	9,931.25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	68.75
Oklahoma	10,000	8,465.62	.....	.....	.....	.....	.....	199.00	.....	.....	797.20	.....	.....	.....	.....	538.18
Oregon	10,000	6,799.14	293.72	428.21	77.05	45.87	.....	151.19	.....	38.41	.....	7.65	.....	2,158.76	.....	.....

TABLE XXI.—*Expenditures from the United States appropriation of May 8, 1914, for cooperative agricultural extension for the year ended June 30, 1915, by items of expense*—Continued.

State.	Amount of appropriation.	Classified expenditures.														
		Salaries.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.	Unexpended balance.
Pennsylvania	$10,000	$4,737.52	$242.41	$21.15	$326.72	$1,023.95	.....	$220.16	$18.62	$9.06	$9.25	.....	.....	$3,265.96	$125.20	.....
Rhode Island	10,000	6,588.50	5.88	449.73	283.65	335.57	.....	227.41	6.80	.....	397.60	$98.06	.....	1,605.30	1.50	.....
South Carolina	10,000	4,833.20	419.45	475.00	37.50	127.25	.....	103.04	10.80	11.10	204.70	.....	.....	3,777.96	.....	.....
South Dakota	10,000	6,141.57	81.70	.....	.....	69.83	.....	43.48	.....	.....	435.73	.....	.....	3,209.69	18.00	.....
Tennessee	10,000	6,239.99	109.95	479.82	273.87	146.19	.....	47.65	.....	.....	858.01	.....	.....	1,839.52	5.00	.....
Texas	10,000	5,355.09	71.30	75.75	212.86	3.45	.....	.....	2.41	42.25	337.82	12.50	.....	3,865.75	.....	$20.82
Utah	10,000	6,743.76	.....	58.00	51.25	202.25	.....	60.45	.....	12.26	143.85	131.25	.....	2,595.93	.....	.....
Vermont	10,000	5,309.22	261.64	160.63	437.32	326.35	.....	483.08	40.76	58.83	351.20	55.65	.....	2,515.32	.....	.....
Virginia	10,000	9,997.43	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.57
Washington	10,000	7,438.79	28.15	.....	50.58	116.68	.....	33.55	.....	23.05	283.37	45.40	.....	1,980.43	.....	.....
West Virginia	10,000	7,024.74	.....	.....	245.17	.....	.....	126.33	.....	.....	.....	.....	.....	2,603.76	.....	.....
Wisconsin	10,000	9,101.70	.....	.....	.....	.....	.....	98.40	.....	.....	.35	.....	.....	799.55	.....	.....
Wyoming	10,000	4,739.80	46.50	70.00	182.27	155.46	.....	223.79	9.61	113.17	684.70	79.76	.....	3,694.94	.....	.....
Total	480,000	322,631.44	6,511.70	8,241.16	9,270.05	5,539.85	$146.85	6,193.34	304.56	1,739.53	15,131.40	2,431.69	$162.34	96,402.41	228.41	5,065.27

TABLE XXII.—*Expenditures from the United States appropriation of May 8, 1914, for cooperative agricultural extension for the year ended June 30, 1915, by projects.*

State.	Amount appropriated.	Expenditures by projects.										
		Administration.	Printing and distribution of publications.	County agents.	Home economics.[1]	Movable schools.	Boys' clubs.[1]	Pig clubs.	Poultry clubs.	Animal husbandry.	Poultry.	Dairying.
Alabama	$10,000	$1,545.31	$485.03		$2,763.44	$1,700.84	$700.00	$326.82				$1,118.09
Arizona	10,000	4,830.81	74.25	$1,085.56			977.07			$2,137.33		
Arkansas	10,000	909.15	306.25	2,948.80	500.00		900.00					
California	10,000			10,000.00								
Colorado	10,000	2,079.28	117.75	3,082.10	3,240.29		1,480.58					
Connecticut	10,000	2,428.45	221.25	1,306.92			1,464.47				$1,682.33	2,095.63
Delaware	10,000	2,131.23	129.50	5,853.21	627.58		50.00				423.86	
Florida	10,000	1,263.26	391.24	5,348.80	2,343.05							71.75
Georgia	10,000	2,911.43	500.00		2,783.41	1,357.17	830.18			1,544.95		
Idaho	10,000	2,728.32	271.25	3,369.70	2,652.97		648.45					329.31
Illinois	10,000	1,385.27	65.50	3,170.92	2,978.31							
Indiana	10,000	1,724.40		165.41	2,832.08	1,475.00					1,162.61	
Iowa	10,000	188.11		2,600.00	1,100.00							
Kansas	10,000			3,966.65	2,782.68							
Kentucky	10,000	3,427.39	301.20		3,475.82	234.90	722.57					236.34
Louisiana	10,000	1,668.07	447.03	300.00	40.00		4,180.79					188.00
Maine	10,000	773.33	276.56	8,950.11								
Maryland	10,000	3,572.63	157.50		458.59	1,328.67					402.05	
Massachusetts	10,000		500.00	1,395.90	2,633.43		1,209.37			1,255.17		986.32
Michigan	10,000	833.66	389.50	3,041.38	1,658.18		698.35					
Minnesota	10,000	898.19		3,593.73		3,749.76						1,758.32
Mississippi	10,000	2,064.15	96.05		3,250.93					2,290.27		
Missouri	10,000	1,036.35	48.50			965.89	3,433.36				43.56	1,917.13
Montana	10,000	2,457.75	73.50	4,839.88	1,405.00	56.90	56.66			833.31		
Nebraska	10,000	1,790.39		2,164.64	2,057.68							
Nevada	10,000	2,825.32	60.00		1,844.81							1,005.38
New Hampshire	10,000	1,166.19		2,804.21	978.08	1,248.62						1,455.53
New Jersey	10,000	2,473.68	493.07	738.32	1,774.44							
New Mexico	10,000	3,739.15	390.00	891.21	1,474.13		1,410.44					
New York	10,000	300.00			1,950.00	1,485.00						
North Carolina	10,000	932.46	227.94	3,483.34	1,724.23		1,838.39					600.00
North Dakota	10,000			10,000.00								
Ohio	10,000	1,000.00			3,000.00	5,931.25						
Oklahoma	10,000	996.20		5,019.37	3,446.25							
Oregon	10,000	953.34	428.21		233.32	2,999.76	1,007.21					

[1] In some States also includes girls' club work.

TABLE XXII.—*Expenditures from the United States appropriation of May 8, 1914, for cooperative agricultural extension for the year ended June 30, 1915, by projects*—Continued.

State.	Amount appropriated.	Expenditures by projects.										
		Administration.	Printing and distribution of publications.	County agents.	Home economics.	Movable schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal husbandry.	Poultry.	Dairying.
Pennsylvania	$10,000	$1,046.03	$21.15	$5,858.72		$968.95						$84.71
Rhode Island	10,000	3,989.68	449.73	1,161.48	$1,581.58		$1,524.52					
South Carolina	10,000	1,725.07	475.00	3,335.89	557.68					$48.41	$1,659.35	1,475.05
South Dakota	10,000	617.44		493.01	2,112.58		798.40					
Tennessee	10,000	3,790.16	479.82	2,116.66	687.50	176.61			$362.07	204.58		661.47
Texas	10,000	3,777.39	75.75	900.00	1,979.99	2,665.90						
Utah	10,000	2,585.08	58.00	1,446.62	452.90		2,319.74					168.50
Vermont	10,000	2,273.96	160.63	3,549.91		3,014.27	909.40					37.25
Virginia	10,000	696.70		5,934.40	1,636.35							
Washington	10,000	2,017.81		3,829.19	666.10		2,377.42					889.78
West Virginia	10,000	861.02		4,623.26	1,423.65	1,175.50	1,916.57					
Wisconsin	10,000	1,885.31		4,499.76		3,014.93						
Wyoming	10,000	3,979.47	70.00	214.27	2,783.02	271.73	1,490.35					1,191.16
Total	480,000	86,278.39	8,241.16	128,083.33	69,890.05	33,821.65	32,944.29	$326.82	362.07	8,314.02	5,373.76	16,269.72

TABLE XXII.—*Expenditures from the United States appropriation of May 8, 1914, for cooperative agricultural extension for the year ended June 30, 1915, by projects*—Continued.

State.	Expenditures by projects.											
	Animal diseases.	Agronomy.	Horticulture.	Plant pathology.	Entomology and ornithology.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Miscellaneous specialists.	Balance.
Alabama		$804.21									$556.26	
Arizona											894.98	
Arkansas											4,435.80	
California												
Colorado												
Connecticut			$785.67									$15.28
Delaware		240.00	421.77								122.85	
Florida	$56.90		450.00									75.00
Georgia												72.86
Idaho												
Illinois											2,400.00	
Indiana			1,925.30								715.20	
Iowa		620.37								$625.00	4,866.52	
Kansas											3,250.67	
Kentucky		310.18	1,051.55					$114.68				125.37
Louisiana			1,209.01								590.44	1,376.66
Maine												
Maryland		1,698.50	1,106.67				$1,025.39					250.00
Massachusetts			995.56							1,024.25		
Michigan		638.29	2,699.44				41.20					
Minnesota												
Mississippi									$2,298.60			
Missouri	2,555.21											
Montana							277.00					
Nebraska											3,987.29	
Nevada	1,318.56	399.33			$40.00							2,506.60
New Hampshire			2,347.37									
New Jersey											4,507.31	13.18
New Mexico											2,095.07	
New York		1,800.00	1,350.00	$400.00	400.00		2,315.00					
North Carolina			1,193.64									
North Dakota												
Ohio												68.75
Oklahoma												538.18
Oregon											4,378.16	
Pennsylvania								11.32		2,009.12		
Rhode Island		1,243.01	50.00									

TABLE XXII.—*Expenditures from the United States appropriation of May 8, 1914, for cooperative agricultural extension for the year ended June 30, 1915, by projects*—Continued.

State.	Expenditures by projects.											
	Animal diseases.	Agronomy.	Horticulture.	Plant pathology.	Entomology and ornithology.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Miscellaneous specialists.	Balance.
South Carolina			$723.55									
South Dakota											$5,978.57	
Tennessee		$1,488.10									83.03	
Texas						$580.15						$20.82
Utah							$491.02				2,478.14	
Vermont										$54.58		
Virginia											1,729.98	2.57
Washington							219.70					
West Virginia												
Wisconsin						600.00						
Wyoming												
Total	$3,930.67	9,191.99	16,309.53	$400.00	$440.00	1,180.15	4,369.31	$126.00	$2,298.60	3,712.95	43,070.27	5,065.27

TABLE XXIII.—*Expenditures for cooperative agricultural extension for the year ended June 30, 1915, by sources of funds.*

State.	Total.	United States Department of Agriculture.		Smith-Lever.	State.	County.	College.	Other.
		States Relations Service.	Other bureaus and offices.					
Alabama	$113,087.81	$47,522.15	$4,114.20	$10,000.00	$28,592.35	$19,375.32	$825.00	$2,658.79
Arizona	17,279.71	1,858.33	.....	10,000.00	4,444.35	57.38	.....	919.65
Arkansas	111,348.52	41,574.89	2,619.83	10,000.00	6,236.65	43,212.67	4,666.98	3,037.50
California	68,323.69	6,192.73	.....	10,000.00	27,529.56	22,000.00	.....	2,601.40
Colorado	29,688.18	9,883.60	.....	10,000.00	1,440.51	8,364.07	.....	.....
Connecticut	25,226.74	6,101.26	550.00	9,984.72	3,590.76	.....	.....	5,000.00
Delaware	18,595.88	2,205.23	260.00	10,000.00	5,000.00	.....	.....	1,130.65
Florida	73,984.33	26,347.55	145.00	9,925.00	5,000.00	16,106.78	10,695.00	5,765.00
Georgia	124,871.50	49,504.04	9,451.49	9,927.14	15,675.00	28,313.83	.....	12,000.00
Idaho	24,446.86	4,800.00	1,525.00	10,000.00	6,005.47	1,616.39	.....	500.00
Illinois	91,766.63	16,726.63	240.00	10,000.00	.....	14,600.00	200.00	50,000.00
Indiana	138,259.36	13,066.39	1,614.11	10,000.00	64,145.39	44,935.46	.....	4,498.01
Iowa	192,141.51	17,216.52	6,070.00	10,000.00	88,704.99	4,000.00	.....	66,150.00
Kansas	92,629.77	14,046.92	.....	10,000.00	.....	.....	50,700.63	17,882.22
Kentucky	87,533.85	36,861.10	3,015.98	9,874.63	.....	31,928.12	5,854.02	.....
Louisiana	83,958.98	43,946.49	1,954.60	8,623.34	.....	22,587.50	6,847.05	.....
Maine	[1] 11,820.32	1,360.32	460.00	10,000.00	.....	.....	.....	.....
Maryland	40,843.91	14,976.67	2,851.00	9,750.00	3,000.00	4,566.24	5,700.00	.....
Massachusetts	119,183.69	11,572.34	.....	10,000.00	.....	45,000.00	52,611.35	.....
Michigan	64,562.66	17,376.82	800.00	10,000.00	.....	19,540.00	16,845.84	.....
Minnesota	170,783.12	16,218.16	5,432.00	10,000.00	21,269.91	18,285.78	66,988.79	32,588.48
Mississippi	93,791.70	48,117.68	3,076.00	10,000.00	800.00	29,810.52	1,987.50	.....
Missouri	71,111.87	11,033.84	.....	10,000.00	32,015.93	17,410.44	651.66	.....
Montana	29,673.53	6,456.26	1,334.00	10,000.00	4,191.07	2,308.13	5,384.07	.....
Nebraska	79,533.27	15,538.43	2,794.84	10,000.00	25,000.00	6,200.00	.....	20,000.00
Nevada	8,677.40	.....	1,184.00	7,493.40	.....	.....	.....	.....
New Hampshire	[2] 22,976.68	5,073.68	90.00	10,000.00	300.00	3,500.00	2,000.00	2,013.00
New Jersey	30,096.81	4,959.42	200.00	9,986.82	13,950.57	.....	.....	1,000.00
New Mexico	18,456.30	6,833.05	479.00	10,000.00	.....	539.99	604.26	.....
New York	183,604.61	26,586.61	.....	10,000.00	57,200.00	82,818.00	7,000.00	.....
North Carolina	133,508.23	40,799.84	11,283.39	10,000.00	31,900.00	38,000.00	1,525.00	.....
North Dakota	65,050.61	9,449.14	726.00	10,000.00	13,269.74	31,605.73	.....	.....
Ohio	50,898.26	2,181.67	700.00	9,931.25	38,085.34	.....	.....	.....
Oklahoma	101,736.79	41,002.99	234.00	9,461.82	.....	9,935.01	18,114.90	22,988.07
Oregon	92,741.11	7,787.34	2,774.00	10,000.00	56,087.19	15,827.08	.....	265.50
Pennsylvania	47,639.84	18,442.02	800.00	10,000.00	10,128.42	.....	5,261.63	3,007.77
Rhode Island	13,310.78	2,242.54	210.00	10,000.00	.....	858.24	.....	.....
South Carolina	109,581.93	43,635.28	12,254.26	10,000.00	.....	17,401.20	20,290.48	6,000.71

[1] Does not include $19,500 from sources outside the State.

[2] Does not include $10,000 from sources outside the State.

TABLE XXIII.—*Expenditures for cooperative agricultural extension for the year ended June 30, 1915, by sources of funds*—Continued.

State.	Total.	United States Department of Agriculture.		Smith-Lever.	State.	County.	College.	Other.
		States Relations Service.	Other bureaus and offices.					
South Dakota	$42,857.69	$5,068.84	.....	$10,000.00	$20,000.00	$2,097.65	$610.45	$5,080.75
Tennessee	86,597.93	31,200.90	$6,149.70	10,000.00	1,715.84	28,882.13	6,895.07	1,754.29
Texas	195,981.23	72,402.89	6,447.00	9,979.18	17,473.79	76,097.16	13,581.21	.....
Utah	51,558.62	9,677.77	1,890.00	10,000.00	25,283.79	2,989.08	.....	1,717.98
Vermont	41,845.71	10,088.05	3,387.00	10,000.00	7,570.66	10,800.00	.....	.....
Virginia	108,598.29	38,420.18	3,781.00	9,997.43	26,661.01	25,470.57	.....	4,268.10
Washington	58,119.32	8,901.83	1,603.00	10,000.00	3,008.81	19,034.08	13,984.36	1,587.24
West Virginia	80,886.10	23,283.98	1,155.00	10,000.00	34,402.26	411.42	.....	11,633.44
Wisconsin	51,621.89	11,422.30	388.00	10,000.00	19,765.77	10,045.82	.....	.....
Wyoming	26,442.33	5,817.33	1,125.00	10,000.00	5,000.00	3,800.00	.....	700.00
Total	3,597,235.85	905,782.00	105,168.40	474,934.73	724,445.13	780,331.79	319,825.25	286,748.55

TABLE XXIV.—*Total expenditures of funds from all sources for cooperative agricultural-extension work for the year ended June 30, 1915, by projects.*

State.	Total.	Expenditures by projects.											
		Administration.	Printing and distribution of publications.	County agents.	Home economics.[1]	Movable schools.	Boys' clubs.[1]	Pig clubs.	Poultry clubs.	Animal husbandry.	Poultry.	Dairying.	Animal diseases.
Alabama	$113,087.81	$1,545.31	$485.03	$79,302.60	$16,155.87	$1,700.84	$6,978.58	$1,863.02	.....	.....	.....	$3,696.09	.....
Arizona	17,279.71	5,330.81	324.25	3,320.92	.....	500.00	1,717.07	.....	.....	$2,137.33	.....	.....	.....
Arkansas	111,348.52	3,937.32	1,472.03	78,619.31	11,261.96	.....	2,352.59	.....	.....	982.83	.....	1,637.00	.....
California[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colorado	29,688.18	2,835.64	141.50	18,262.04	3,752.72	.....	3,280.09	.....	.....	.....	.....	.....	.....
Connecticut	25,226.74	3,292.19	258.75	8,440.60	.....	823.60	3,123.95	.....	.....	.....	$1,682.33	2,645.63	.....
Delaware	18,595.88	2,939.97	405.25	9,286.72	643.93	.....	655.23	.....	.....	.....	1,052.16	260.00	.....
Florida	73,984.33	3,713.26	391.24	46,404.38	22,211.80	.....	540.00	.....	.....	.....	.....	216.75	$56.90
Georgia	124,871.50	2,911.43	843.82	75,839.95	14,222.39	1,357.17	18,700.30	1,983.88	$1,151.75	5,059.81	.....	2,801.00	.....
Idaho	24,446.86	4,310.67	575.50	8,948.64	3,044.41	370.32	3,634.19	.....	.....	1,178.27	.....	1,854.31	5.00
Illinois	91,766.63	1,385.27	113.50	83,965.58	2,978.31	.....	683.97	.....	.....	.....	.....	240.00	.....
Indiana	138,259.36	17,662.02	1,831.17	71,719.76	4,780.57	3,318.90	3,115.00	1,261.11	.....	1,074.44	1,531.31	4,184.45	.....
Iowa[3]	192,141.51	22,717.59	7,414.21	39,685.89	19,052.67	36,295.74	8,338.03	.....	.....	.....	.....	6,070.00	.....
Kansas	92,629.77	5,231.18	.....	32,250.82	6,896.74	.....	3,370.42	.....	.....	.....	.....	.....	.....
Kentucky	87,533.85	3,427.39	301.20	61,343.61	15,732.92	234.90	1,765.10	1,447.48	1,368.50	.....	.....	436.34	.....
Louisiana	83,958.98	1,668.07	518.28	56,476.33	9,058.62	.....	12,295.63	1,089.60	.....	.....	.....	1,053.00	.....
Maine[4]	11,820.32	773.33	276.56	8,950.11	.....	.....	.....	.....	.....	.....	.....	460.00	.....
Maryland	40,843.91	5,868.07	157.50	16,175.01	4,102.30	1,441.52	159.55	.....	.....	.....	402.05	5,100.00	.....
Massachusetts[5]	119,183.69	19,160.32	500.00	54,255.66	4,636.83	29,861.11	4,673.70	.....	.....	1,255.17	.....	986.32	.....
Michigan	64,562.66	3,421.31	486.88	40,175.04	2,518.47	1,817.45	3,770.43	.....	.....	560.61	.....	943.20	.....
Minnesota[3]	170,783.12	22,054.98	17,824.86	64,915.17	4,756.13	15,227.31	5,472.64	.....	.....	.....	.....	10,153.21	.....
Mississippi	93,791.70	2,064.15	96.05	60,139.30	18,553.26	.....	5,274.07	.....	.....	2,290.27	.....	3,076.00	.....
Missouri	71,111.87	1,167.73	556.29	46,401.65	.....	10,453.62	4,696.07	.....	.....	.....	43.56	2,370.64	3,183.18
Montana	29,673.53	4,438.99	327.99	16,712.87	1,804.56	92.50	1,823.88	.....	.....	885.17	.....	1,503.75	.....
Nebraska	79,533.27	8,163.52	4,426.87	33,053.20	5,057.68	.....	3,333.33	1,294.84	.....	.....	.....	1,500.00	.....
Nevada	8,677.40	2,825.32	60.00	.....	1,844.81	.....	.....	.....	.....	.....	.....	2,189.38	1,318.56
New Hampshire[5]	22,976.68	3,351.19	515.00	11,042.15	978.08	1,248.62	.....	.....	.....	.....	.....	1,545.53	.....
New Jersey[2]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
New Mexico	18,456.30	3,739.15	911.67	7,389.25	1,474.13	.....	2,368.03	.....	.....	.....	.....	479.00	.....
New York	183,604.61	11,868.00	1,600.00	104,583.01	5,850.00	13,167.00	1,800.04	.....	.....	2,900.00	3,000.00	2,000.00	.....
North Carolina	133,508.23	2,932.46	227.94	76,229.41	25,719.25	.....	7,422.14	1,537.97	1,777.39	6,039.03	.....	8,229.00	.....
North Dakota	65,050.61	5,857.69	540.36	53,582.86	.....	.....	4,343.70	.....	.....	.....	.....	726.00	.....
Ohio	50,898.26	9,058.30	3,300.00	[6]2,181.67	11,560.00	20,898.29	3,200.00	.....	.....	.....	.....	700.00	.....
Oklahoma	101,736.79	12,408.31	861.16	70,875.70	11,123.29	3,894.21	2,340.12	.....	.....	.....	.....	234.00	.....

[1] In some States also includes girls' club work.
[2] Accounts not kept so as to show expenditures by projects.
[3] Distribution of funds among various projects partially estimated.
[4] Does not include $19,500 received from sources outside the State.
[5] Does not include $10,000 received from sources outside the State.
[6] Includes only farmers' cooperative demonstration funds.

TABLE XXIV.—*Total expenditures of funds from all sources for cooperative agricultural extension work for the year ended June 30, 1915, by projects*—Continued.

State.	Total.	Expenditures by projects.											
		Administration.	Printing and distribution of publications.	County agents.	Home economics.	Movable schools.	Boys' clubs.	Pig clubs.	Poultry clubs.	Animal husbandry.	Poultry.	Dairying.	Animal diseases.
Oregon	$92,741.11	$10,497.89	$2,032.63	$36,778.53	$4,016.15	$15,232.75	$7,999.96	.....	.....	.....	.....	$2,774.00	.....
Pennsylvania	47,639.84	5,589.01	3,775.47	25,440.79	1,767.05	3,199.34	.....	.....	.....	.....	.....	2,424.19	.....
Rhode Island	13,310.78	4,336.79	449.73	2,314.23	1,667.70	.....	2,967.93	.....	.....	.....	.....	210.00	.....
South Carolina	109,581.93	4,402.18	907.00	64,472.33	20,565.40	.....	1,523.66	.....	$1,768.05	$5,284.62	$1,758.52	6,725.05	.....
South Dakota	42,857.69	617.44	.....	11,710.11	2,112.58	.....	2,438.99	.....	.....	.....	.....	.....	.....
Tennessee	86,597.93	7,936.40	1,584.12	52,975.21	12,231.90	1,296.82	.....	.....	2,366.52	2,322.63	.....	3,620.47	.....
Texas	195,981.23	24,614.11	2,263.82	132,801.07	17,040.80	7,491.59	2,438.17	.....	.....	.....	.....	6,447.00	.....
Utah	51,558.62	4,206.44	1,638.39	19,538.35	2,191.80	5,506.27	6,287.25	.....	.....	.....	.....	3,035.71	.....
Vermont	41,845.71	4,473.24	160.63	23,784.90	.....	6,087.71	2,449.07	.....	.....	.....	.....	3,585.17	.....
Virginia	108,598.29	2,429.40	154.00	78,846.52	15,438.47	.....	.....	.....	1,573.00	.....	.....	2,208.00	.....
Washington	58,119.32	8,108.34	1,826.84	30,900.29	2,429.25	3,516.99	5,370.74	.....	.....	.....	.....	3,918.73	.....
West Virginia	80,886.10	8,649.53	2,289.89	39,617.23	7,631.08	4,721.72	5,582.35	.....	.....	.....	.....	1,155.00	.....
Wisconsin	51,621.89	1,944.41	5,074.52	33,206.98	.....	6,590.13	1,455.11	.....	.....	.....	.....	388.00	.....
Wyoming	26,442.33	5,442.36	1,695.75	9,314.76	2,958.62	2,007.49	2,707.19	.....	.....	.....	.....	2,316.16	.....
Totals	3,498,815.35	295,308.48	71,597.65	1,902,230.51	319,822.50	198,353.91	162,448.27	$10,477.90	10,005.21	31,970.18	9,469.93	106,098.08	$4,563.64

TABLE XXIV.—*Total expenditures of funds from all sources for cooperative agricultural-extension work for the year ended June 30, 1915, by projects*—Continued.

State.	Expenditures by projects.													
	Agronomy.	Horticulture.	Botany and plant pathology.	Entomology and ornithology.	Forestry.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Farmers' institutes.	Correspondence courses.	Agriculture in schools.	Miscellaneous specialists.
Alabama	$804.21													$556.26
Arizona											$2,800.00			1,149.33
Arkansas														11,085.48
California														
Colorado							$1,416.19							
Connecticut		$785.67					3,196.72							977.30
Delaware	1,070.17	892.68												1,389.77
Florida		450.00												
Georgia														
Idaho		394.40					131.15							
Illinois														2,400.00
Indiana	467.03	3,571.13	$523.17				3,449.47			$2,243.32	16,811.31			715.20
Iowa	1,371.25						2,134.16			1,375.00			$2,340.00	45,346.97
Kansas						$9,525.73	1,483.73	$2,575.01			21,045.84	$6,999.63		3,250.67
Kentucky	310.18	1,051.55						114.68						
Louisiana		1,209.01												590.44
Maine							1,360.32							
Maryland	1,698.50	4,692.67					1,046.74							
Massachusetts		995.56					1,834.77			1,024.25				
Michigan	2,296.91	4,494.01			$1,965.44		2,112.91							
Minnesota							13,543.88				14,334.94		2,500.00	
Mississippi									$2,298.60					
Missouri		675.08				30.15	850.32	31.92		651.66				
Montana							2,083.82							
Nebraska							3,716.54				10,000.00			8,987.29
Nevada	399.33			$40.00										
New Hampshire		2,347.37					1,948.74							
New Jersey														
New Mexico														2,095.07
New York	9,000.00	4,950.00	4,400.00	3,900.00	2,000.00		5,336.56			2,500.00				4,750.00
North Carolina		1,193.64				2,200.00								
North Dakota														
Ohio														
Oklahoma														
Oregon														13,409.20
Pennsylvania								2,338.73		3,105.26				
Rhode Island	1,314.40	50.00												

TABLE XXIV.—*Total expenditures of funds from all sources for cooperative agricultural-extension work for the year ended June 30, 1915, by projects*—Continued.

State.	Expenditures by projects.													
	Agronomy.	Horticulture.	Botany and plant pathology.	Entomology and ornithology.	Forestry.	Agricultural engineering.	Farm management.	Rural organization.	Marketing.	Exhibits and fairs.	Farmers' institutes.	Correspondence courses.	Agriculture in schools.	Miscellaneous specialists.
South Carolina		$2,175.12												
South Dakota											$20,000.00			$5,978.57
Tennessee	$2,180.83													83.03
Texas						$580.15				$610.49				1,694.03
Utah							$1,579.94					$600.00		6,974.47
Vermont										1,208.83				96.16
Virginia														7,948.90
Washington							2,048.14							
West Virginia										1,300.40	7,387.00	843.01	$8,917.08	
Wisconsin						705.57	2,257.17							
Wyoming														
Total	20,912.81	29,927.89	$4,923.17	$3,940.00	$3,965.44	13,041.60	51,531.27	$5,060.34	$2,298.60	14,019.21	92,379.09	8,442.64	6,548.89	119,478.14

TABLE XXV.—*Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1915, by items of expense.*

State.	Total.	Classified expenditures.													
		Salaries.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.
Alabama	$113,087.81	$96,209.24	$418.89	$485.03	$394.77	$407.89	$5.00	$789.14	.....	.....	$271.34	$226.74	.....	$13,879.77	.....
Arizona	17,279.71	8,385.15	575.26	324.25	591.97	550.29	10.70	1,106.11	.....	$74.73	794.75	47.98	.....	4,810.32	$8.20
Arkansas	111,348.52	94,818.90	34.00	1,472.03	428.66	249.60	.....	730.12	.....	.....	630.32	.....	.....	12,534.95	449.94
California	68,323.69	30,660.60	2,643.92	.....	253.09	491.42	.....	83.30	.....	10.38	680.44	309.80	.....	31,867.42	1,323.32
Colorado	29,688.18	16,989.37	473.41	141.50	879.09	420.28	.....	342.83	$5.32	12.80	516.02	282.15	.....	9,625.41	.....
Connecticut	25,226.74	14,502.74	328.91	258.75	576.36	359.33	.....	435.73	6.00	36.44	897.52	34.70	21.30	7,763.96	5.00
Delaware	18,595.88	12,336.03	64.23	405.25	644.45	392.21	.....	727.03	6.29	1,033.15	326.41	70.10	.....	2,532.93	57.80
Florida	73,984.33	65,402.74	83.20	391.24	109.35	37.01	.....	54.30	2.14	.....	39.50	.....	.....	7,864.85	.....
Georgia	124,871.50	105,080.13	167.75	843.82	443.21	382.67	128.75	2,387.15	.....	29.00	874.05	244.20	141.04	12,895.33	1,254.40
Idaho[1]	24,446.86	15,704.42	46.08	575.50	134.10	124.53	1.00	82.15	3.00	5.45	.....	44.40	.....	7,724.23	2.00
Illinois	91,766.63	74,463.72	2.74	113.50	109.81	53.31	.....	63.21	49.60	163.50	1,394.82	92.54	.....	15,259.88	.....
Indiana	138,259.36	93,339.04	4,123.59	1,831.17	2,123.75	2,501.83	1,046.66	1,920.75	.....	110.89	1,107.91	.....	93.65	30,060.12	.....
Iowa[1]	192,141.51	96,381.84	16,544.09	7,414.21	14,677.31	8,407.51	8,202.00	6,412.42	.....	67.78	2,044.02	313.15	2,000.00	29,588.28	88.90
Kansas	92,629.77	64,988.04	7,705.61	.....	758.29	1,952.89	.....	1,848.99	.....	.....	1,466.78	.....	.....	13,223.33	685.84
Kentucky	87,533.85	74,325.24	5.15	301.20	168.50	122.04	.....	95.20	.....	.....	994.93	.....	.....	11,473.59	48.00
Louisiana	83,958.98	73,071.14	58.77	518.28	753.97	470.49	.....	110.79	.....	123.48	86.03	70.89	.....	8,602.51	92.63
Maine[2]	11,820.32	7,278.56	.....	276.56	374.86	.....	.....	6.47	29.72	570.02	173.75	84.00	.....	2,982.67	43.71
Maryland	40,843.91	32,090.01	1,008.73	157.50	451.35	489.04	.....	997.19	.....	397.79	669.84	353.79	.....	4,228.67	.....
Massachusetts[1]	119,183.69	92,978.02	1,261.06	500.00	1,069.05	.....	.....	11,710.12	.....	.....	176.90	.....	.....	11,488.54	.....
Michigan	64,562.66	40,516.15	1,711.11	486.88	.....	527.34	.....	631.49	.....	16.15	116.48	.....	.....	20,557.06	.....
Minnesota[1]	170,783.12	101,221.99	8,436.26	17,824.86	1,337.69	1,496.82	63.93	1,626.48	10.97	2,284.26	1,205.86	403.09	.....	33,094.50	1,776.41
Mississippi	93,791.70	82,551.05	.....	96.05	162.05	249.66	.....	79.07	.....	.....	160.80	24.00	.....	10,129.02	340.00
Missouri[1]	71,111.87	56,089.23	522.39	556.29	1,174.28	343.97	7.73	1,561.44	.....	8.35	453.88	823.56	.....	9,555.95	14.80
Montana	29,673.53	18,215.20	130.35	327.99	886.39	391.82	.....	927.73	6.38	25.05	736.02	1.85	.....	8,021.40	3.35
Nebraska[1]	79,533.27	47,003.83	7.35	4,426.87	557.73	585.89	.....	36.38	.....	.....	2,599.00	.....	.....	24,305.27	10.95
Nevada	8,677.40	5,500.97	4.75	60.00	269.08	66.38	.....	53.01	2.00	186.71	440.07	75.40	.....	2,019.03	.....
New Hampshire[3]	22,976.68	12,936.22	589.61	515.00	569.37	373.81	.....	1,939.22	18.05	7.44	688.56	78.28	.....	5,259.02	2.10
New Jersey[1]	30,096.81	25,100.67	.....	493.07	249.86	240.61	.....	620.13	19.75	57.45	395.25	58.17	.....	2,784.31	77.54
New Mexico	18,456.30	11,247.62	19.58	911.67	239.64	96.06	.....	29.29	81.57	47.88	598.68	182.35	.....	4,996.96	5.00
New York[1]	183,604.61	112,490.52	11,448.58	1,600.00	5,662.39	4,585.88	.....	4,600.49	10.86	43.45	3,980.86	1,146.14	.....	32,944.69	5,090.75
North Carolina	133,508.23	120,944.04	252.48	227.94	152.12	30.28	1.40	58.15	.....	109.11	847.14	2.80	.....	10,882.77	.....
North Dakota	65,050.61	47,818.69	249.15	540.36	871.06	14.35	.....	407.69	.....	791.86	42.25	41.89	.....	14,155.01	118.30
Ohio	50,898.26	32,099.37	900.00	3,300.00	1,200.00	2,250.00	.....	2,124.58	57.33	.....	983.11	150.00	.....	7,790.69	43.18

[1] Figures partially estimated.
[2] Does not include $19,500 received from sources outside the State.
[3] Does not include $10,000 received from sources outside the State.

TABLE XXV.—*Total expenditures of funds from all sources for cooperative agricultural extension for the year ended June 30, 1915, by items of expense*—Continued.

State.	Total.	Classified expenditures.													
		Salaries.	Labor.	Publications.	Stationery and small printing.	Postage, telegraph, telephone, freight, and express.	Heat, light, water, and power.	Supplies.	Library.	Tools, machinery, and appliances.	Furniture and fixtures.	Scientific apparatus and specimens.	Live stock.	Traveling expenses.	Contingent expenses.
Oklahoma	$101,736.79	$85,242.86	$586.47	$861.16	$633.30	$363.03	$75.25	$877.64	.....	$13.00	1,217.65	$46.45	.....	$11,237.62	$582.36
Oregon	92,741.11	55,462.48	3,846.22	2,032.63	2,518.38	45.87	25.50	2,880.94	$1.60	5,718.62	1,730.67	171.62	.....	17,789.83	516.75
Pennsylvania	47,639.84	29,467.55	755.29	3,775.47	556.33	1,926.63	.....	602.40	27.79	17.06	382.45	.....	.....	9,954.38	174.49
Rhode Island	13,310.78	8,992.49	148.00	449.73	449.65	473.68	.....	368.66	36.70	.....	628.50	98.06	.....	1,663.81	1.50
South Carolina	109,581.93	94,292.24	536.81	907.00	317.94	310.65	.....	183.06	10.80	123.33	208.35	.....	.....	12,677.75	14.00
South Dakota	42,857.69	28,113.35	275.68	.....	753.63	480.13	38.00	405.61	200.00	11.60	514.33	.....	.....	11,640.16	425.20
Tennessee	86,597.93	71,640.75	253.62	1,584.12	478.58	185.80	.....	145.04	.....	.....	858.01	.....	.....	9,662.46	1,789.55
Texas	195,981.23	166,640.89	325.00	2,263.82	2,018.05	807.02	.....	38.20	5.41	1,358.52	907.23	41.06	.....	21,195.21	380.82
Utah	51,558.62	32,620.77	.....	1,638.39	51.25	202.25	.....	706.84	.....	2,897.49	143.85	131.25	.....	9,882.70	3,283.83
Vermont	41,845.71	26,550.84	866.02	160.63	772.70	765.44	1.60	865.59	41.61	62.55	410.21	116.85	.....	11,231.67	.....
Virginia	108,598.29	95,607.45	295.59	154.00	180.15	209.07	.....	461.66	.....	.....	263.88	254.09	.....	11,042.90	129.50
Washington	58,119.32	34,541.68	1,099.71	1,826.84	251.88	914.23	.....	716.69	29.90	23.05	906.88	512.24	.....	17,296.22	.....
West Virginia	80,886.10	56,994.26	753.28	2,289.89	1,919.83	1,703.55	7.27	638.46	10.00	31.97	716.24	44.42	.....	15,535.93	241.00
Wisconsin	51,621.89	31,823.96	97.40	5,074.52	84.83	229.88	.....	2,002.88	17.08	44.74	181.17	212.44	.....	11,852.99	.....
Wyoming	26,442.33	16,237.81	298.00	1,695.75	380.37	155.46	.....	394.33	17.61	579.62	692.95	79.76	.....	5,866.67	44.00
Total	3,597,235.85	2,616,969.86	69,954.09	72,090.72	49,640.47	37,437.90	9,614.79	55,886.15	707.48	17,094.67	36,155.66	6,870.21	$2,255.99	603,432.74	19,125.12

TABLE XXVI.—*Number of counties with county agents and expenditures for county-agent work for the fiscal year ended June 30, 1915.*

State.	Number of agricultural counties.	Number of counties with agent.		Total expenditures.	Salaries.	Travel.	Other expenses.
		July 1, 1914.	July 1, 1915.				
Alabama	67	67	67	$79,302.60	$72,065.21	$7,202.45	$34.94
Arizona	6	0	3	3,320.92	1,549.62	1,414.81	356.49
Arkansas	75	45	52	78,619.31	72,302.52	6,124.84	191.95
California [1]	(45)	(4)	(11)				
Colorado	35	13	13	18,262.04	11,209.88	6,363.65	688.51
Connecticut	8	1	6	8,440.60	4,179.14	3,602.05	659.41
Delaware	3	0	3	9,286.72	6,304.81	1,185.04	1,796.87
Florida	50	25	36	46,404.38	42,572.74	3,831.64	
Georgia	152	80	81	75,839.95	72,079.51	3,760.44	
Idaho [2]	30	2	3	8,948.64	6,841.01	2,042.21	65.42
Illinois	102	14	18	83,965.58	69,127.00	14,837.02	1.56
Indiana	92	27	31	71,719.76	55,731.20	15,988.56	
Iowa [2]	99	9	11	39,685.89	26,889.78	5,096.11	7,700.00
Kansas	105	9	39	32,250.82	23,797.91	8,093.03	359.88
Kentucky	120	28	39	61,343.61	55,923.28	5,420.33	
Louisiana	64	41	43	56,476.33	52,984.19	3,483.89	8.25
Maine	16	0	3	8,950.11	5,322.61	2,542.35	1,085.15
Maryland	23	8	13	16,175.01	15,577.76	597.25	
Massachusetts [2]	13	1	10	54,255.66	53,402.03	848.13	5.50
Michigan	82	11	17	40,175.04	25,842.48	14,067.12	265.44
Minnesota [2]	86	27	23	64,915.17	45,090.30	12,238.85	7,586.02
Mississippi	80	48	49	60,139.30	55,393.75	4,313.75	431.80
Missouri [2]	114	13	15	46,401.65	40,668.51	5,733.14	
Montana	41	4	8	16,712.87	9,894.57	5,874.92	943.38
Nebraska [2]	93	5	8	33,053.20	24,252.01	7,062.36	1,738.83
Nevada	15	0	0				
New Hampshire	10	1	5	11,042.15	6,666.36	2,286.15	2,089.64
New Jersey [1]	(19)	(4)	(7)				
New Mexico	26	0	8	7,389.25	6,160.28	1 226.94	2.03
New York [2]	57	25	29	104,583.01	63,976.48	19,490.59	21.115.94
North Carolina	100	51	64	76,229.41	72,245.22	3,984.19	
North Dakota	51	17	15	53,582.86	39,398.83	13,196.08	987.95
Ohio [1]	(75)	(8)	(10)				
Oklahoma	77	40	56	70,875.70	65,605.92	5,220.58	49.20
Oregon	35	10	12	36,778.53	27,991.89	2,870.70	5,915.94
Pennsylvania	67	10	14	25,440.79	20,309.21	4,947.73	183.85
Rhode Island	5	0	0	2,314.23	1,580.08	406.87	327.28
South Carolina	44	43	43	64,472.33	60,051.25	4,421.08	
South Dakota	66	3	5	11,710.11	8,175.77	1,882.42	1,651.92
Tennessee	96	36	38	52,975.21	47,962.35	4,982.31	30.55
Texas	250	98	99	132,801.07	123,932.87	8,768.40	99.80
Utah	28	8	10	19,538.35	11,484.98	2,645.37	5,408.00
Vermont	14	7	9	23,784.90	15,592.77	7,6 4.69	577.44
Virginia	100	53	55	78.846.52	72,660.00	5,941.30	245.22
Washington	37	7	10	30,900.29	19.708.75	11,005.22	186.32
West Virginia	55	13	27	39,617.23	31,193.94	7,507.50	915.79
Wisconsin	71	9	12	33,206.98	24,565.46	6,547.31	2,094.21
Wyoming	21	3	6	9,314.76	8,579.17	483.09	252.50
Total [3]	2,781	912	1,108	1,900,048.84	1,576,843.40	257,152.46	66,052.98

[1] Accounts not kept so as to show expenditures for county-agent work.
[2] Figures partially estimated.
[3] Do not include 139 agricultural counties, and 16 and 28 agents, respectively, the sum of the figures for the number of agricultural counties and the number of counties with agent in California, New Jersey, and Ohio, for which no expenditures are given.

TABLE XXVII.—*Number of persons on extension staffs classified according to the time devoted to agricultural-extension work for the fiscal year ended June 30, 1915.*

State.	Full time.	Half time.	Less than half time.	Also connected with experiment station.		Also connected with college teaching.	
				Half time.	Less than half time.	Half time.	Less than half time.
Alabama	84	.....	4	.....	2	.....	2
Arizona	4	1	11	.....	10	1	5
Arkansas	81	.....	12	.....	12	.....	12
California	26	.....	15	.....	15	.....	15
Colorado	18	1	5	.....	1	1	5
Connecticut	6	.....	1	.....	.....	.....	.....
Delaware	5	1	8	.....	7	.....	7
Florida	64	4	11	.....	9	1	3
Georgia	112	0	20	.....	20	.....	.....
Idaho	14	1	24	.....	10	.....	12
Illinois	20	2	8	.....	7	1	6
Indiana	60	.....	23	.....	.....	.....	.....
Iowa	36	.....	36	.....	.....	1	.....
Kansas	40	.....	.....	.....	.....	.....	.....
Kentucky	46	.....	4	.....	.....	.....	4
Louisiana	50	1	.....	1	.....	.....	.....
Maine	6	1	16	.....	.....	.....	16
Maryland	27	2	7	.....	1	2	6
Massachusetts	24	2	10	.....	4	2	10
Michigan	27	.....	10	.....	.....	.....	.....
Minnesota	45	.....	12	.....	.....	.....	.....
Mississippi	93	1	.....	.....	.....	1	.....
Missouri	34	.....	31	.....	28	.....	31
Montana	14	2	1	.....	.....	.....	.....
Nebraska	34	1	10	.....	.....	.....	2
Nevada	3	.....	6	.....	6	.....	6
New Hampshire	11	2	13	.....	13	.....	11
New Jersey	17	.....	12	.....	6	.....	6
New Mexico	11	2	7	1	7	2	6
New York	60	4	27	.....	.....	.....	17
North Carolina	82	2	9	2	9	.....	.....
North Dakota	27	.....	2	.....	2	.....	.....
Ohio	26	.....	8	.....	.....	.....	.....
Oklahoma	79	16	2	.....	.....	.....	.....
Oregona	33	3	28	.....	15	2	14
Pennsylvania	20	.....	25	.....	25	.....	25
Rhode Island	4	1	9	.....	4	.....	9
South Carolina	91	.....	.....	.....	.....	.....	.....
South Dakota	4	.....	12	.....	7	.....	12
Tennessee	45	14	13	.....	2	.....	6
Texas	137	.....	1	.....	.....	.....	1
Utah	21	22	29	.....	1	.....	2
Vermont	13	1	5	.....	4	.....	5
Virginia	89	28	7	.....	1	.....	2
Washington	8	1	.....	.....	.....	1	.....
West Virginia	30	21	32	3	.....	3	7
Wisconsin	16	11	103	8	45	9	102
Wyoming	10	1	14	.....	9	.....	7
Total	1,809	149	643	15	282	27	374

TABLE XXVIII.—*Agricultural-extension publications for the fiscal year ended June 30, 1915.*

State.	Number of publications issued.	Number of pages issued.	Number on mailing list.	Total cost.
Alabama	7	14	20,000	$485.03
Arizona	13	123	5,000	324.25
Arkansas	28	75	30,000	1,472.03
California	[1]	.....	26,000	.....
Colorado	5	62	1,500	141.50
Connecticut	6	57	4,000	258.75
Delaware	2	36	3,000	405.25
Florida	3	44	16,000	391.24
Georgia	20	500	36,000	843.82
Idaho	23	[2] 100	5,000	575.50
Illinois	2	16	[3]	113.50
Indiana	29	267	283	1,831.17
Iowa	79	[2] 750	16,270	7,414.21
Kansas	11	154	12,000	[4]
Kentucky	50	202	4,500	301.20
Louisiana	3	68	19,000	518.28
Maine	11	121	4,000	276.56
Maryland	1	2	3,000	157.50
Massachusetts	41	405	17,850	500.00
Michigan	12	108	25,000	486.88
Minnesota	42	216	55,000	17,824.86
Mississippi	7	14	1,000	96.05
Missouri	8	116	15,124	556.29
Montana	14	55	[3]	327.99
Nebraska	7	172	10,000	4,426.87
Nevada	9	144	1,100	60.00
New Hampshire	20	93	12,000	515.00
New Jersey	16	195	10,500	493.07
New Mexico	44	120	7,766	911.67
New York	38	1,110	285,000	1,600.00
North Carolina	1	8	75,000	227.94
North Dakota	2	28	10,000	540.36
Ohio	52	350	35,000	3,300.00
Oklahoma	16	144	1,600	861.16
Oregon	44	642	30,000	2,032.63
Pennsylvania	12	121	35,000	3,775.47
Rhode Island	13	84	[2] 2,000	449.73
South Carolina	17	72	[3]	907.00
Tennessee	6	61	8,000	1,584.12
Texas	7	162	9,012	2,263.82
Utah	44	368	24,621	1,638.39
Vermont	2	10	8,000	160.63
Virginia	12	120	15,000	154.00
Washington	3	12	20,800	1,826.84
West Virginia	28	316	35,000	2,289.89
Wisconsin	7	234	[3]	5,074.52
Wyoming	2	208	13,500	1,695.75
Total	819	8,279	967,426	72,090.72

[1] Experiment-station publications used.
[2] Estimated.
[3] No mailing list established.
[4] No charge, because publications were printed at State printing plant.

APPENDIX.

SMITH-LEVER ACT.

ACT OF 1914 PROVIDING FOR COOPERATIVE EXTENSION WORK.

AN ACT To provide for cooperative agricultural extension work between the agricultural colleges in the several States receiving the benefits of an act of Congress approved July second, eighteen hundred and sixty-two, and of acts supplementary thereto, and the United States Department of Agriculture.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same, there may be inaugurated in connection with the college or colleges in each State now receiving, or which may hereafter receive, the benefits of the act of Congress approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts" (Twelfth Statutes at Large, page five hundred and three), and of the act of Congress approved August thirtieth, eighteen hundred and ninety (Twenty-sixth Statutes at Large, page four hundred and seventeen and chapter eight hundred and forty-one), agricultural extension work which shall be carried on in cooperation with the United States Department of Agriculture: *Provided*, That in any State in which two or more such colleges have been or hereafter may be established the appropriations hereinafter made to such State shall be administered by such college or colleges as the legislature of such State may direct: *Provided further*, That, pending the inauguration and development of the cooperative extension work herein authorized, nothing in this act shall be construed to discontinue either the farm management work or the farmers' cooperative demonstration work as now conducted by the Bureau of Plant Industry of the Department of Agriculture.

SEC. 2. That cooperative agricultural extension work shall consist of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications, and otherwise; and this work shall be carried on in such manner as may be mutually agreed upon by the Secretary of Agriculture and the State agricultural college or colleges receiving the benefits of this act.

SEC. 3. That for the purpose of paying the expenses of said cooperative agricultural extension work and the necessary printing and distributing of information in connection with the same, there is permanently appropriated, out of any money in the Treasury not otherwise appropriated, the sum of $480,000 for each year, $10,000 of which shall be paid annually, in the manner hereinafter provided, to each State which shall by action of its legislature assent to the

provisions of this act: *Provided*, That payment of such installments of the appropriation hereinbefore made as shall become due to any State before the adjournment of the regular session of the legislature meeting next after the passage of this act may, in the absence of prior legislative assent, be made upon the assent of the governor thereof, duly certified to the Secretary of the Treasury: *Provided further*, That there is also appropriated an additional sum of $600,000 for the fiscal year following that in which the foregoing appropriation first becomes available, and for each year thereafter for seven years a sum exceeding by $500,000 the sum appropriated for each preceding year, and for each year thereafter there is permanently appropriated for each year the sum of $4,100,000 in addition to the sum of $480,000 hereinbefore provided: *Provided further*, That before the funds herein appropriated shall become available to any college for any fiscal year plans for the work to be carried on under this act shall be submitted by the proper officials of each college and approved by the Secretary of Agriculture. Such additional sums shall be used only for the purposes hereinbefore stated, and shall be allotted annually to each State by the Secretary of Agriculture and paid in the manner hereinbefore provided, in the proportion which the rural population of each State bears to the total rural population of all the States as determined by the next preceding Federal census: *Provided further*, That no payment out of the additional appropriations herein provided shall be made in any year to any State until an equal sum has been appropriated for that year by the legislature of such State, or provided by State, county, college, local authority, or individual contributions from within the State, for the maintenance of the cooperative agricultural extension work provided for in this act.

SEC. 4. That the sums hereby appropriated for extension work shall be paid in equal semiannual payments on the first day of January and July of each year by the Secretary of the Treasury upon the warrant of the Secretary of Agriculture, out of the Treasury of the United States, to the treasurer or other officer of the State duly authorized by the laws of the State to receive the same; and such officer shall be required to report to the Secretary of Agriculture, on or before the first day of September of each year, a detailed statement of the amount so received during the previous fiscal year, and of its disbursement, on forms prescribed by the Secretary of Agriculture.

SEC. 5. That if any portion of the moneys received by the designated officer of any State for the support and maintenance of cooperative agricultural extension work, as provided in this act, shall by any action or contingency be diminished or lost or be misapplied, it shall be replaced by said State to which it belongs, and until so replaced no subsequent appropriation shall be apportioned or paid to said State, and no portion of said moneys shall be applied, directly or indirectly, to the purchase, erection, preservation, or repair of any building or buildings, or the purchase or rental of land, or in college-course teaching, lectures in colleges, promoting agricultural trains, or any other purpose not specified in this act, and not more than five per centum of each annual appropriation shall be applied to the printing and distribution of publications. It shall be the duty of each of said colleges annually, on or before the first day of January, to make the governor of the State in which it is located a full and detailed report of its operations in the direction of extension work as defined in this act, including a detailed statement of receipts and expenditures from all sources for this purpose, a copy of which report shall be sent to the Secretary of Agriculture and to the Secretary of the Treasury of the United States.

SEC. 6. That on or before the first day of July in each year after the passage of this act the Secretary of agriculture shall ascertain and certify to the Secretary of the Treasury as to each State whether it is entitled to receive its share

of the annual appropriation for cooperative agricultural extension work under this act, and the amount which it is entitled to receive. If the Secretary of Agriculture shall withhold a certificate from any State of its appropriation, the facts and reasons therefor shall be reported to the President, and the amount involved shall be kept separate in the Treasury until the expiration of the Congress next succeeding a session of the legislature of any State from which a certificate has been withheld, in order that the State may, if it should so desire, appeal to Congress from the determination of the Secretary of Agriculture. If the next Congress shall not direct such sum to be paid, it shall be covered into the Treasury.

SEC. 7. That the Secretary of Agriculture shall make an annual report to Congress of the receipts, expenditures, and results of the cooperative agricultural extension work in all of the States receiving the benefits of this act, and also whether the appropriation of any State has been withheld, and if so, the reasons therefor.

SEC. 8. That Congress may at any time alter, amend, or repeal any or all of the provisions of this act.

Approved, May 8, 1914 (38 Stat. L., 372).

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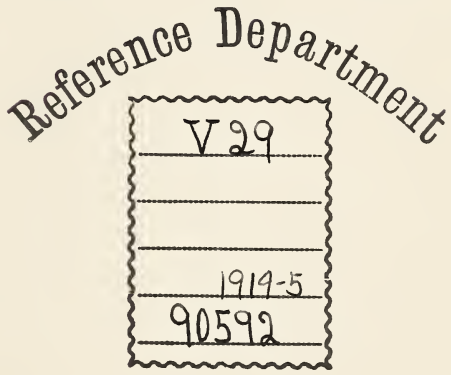
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